Registered at the G.P.O. for Transmission to Canada and Newfoundland by Magazine Post.

VOL. 27. Ser. A. Part 3. pp. 105–160. MARCH, 1939.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

Price 3s. net.

All Rights Reserved.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Executive Council.

Lieut.-Colonel GEORGE P. VANIER, D.S.O., M.C., *Chairman*, Canada.
F. J. DU TOIT, *Vice-Chairman*, Union of South Africa.
Sir DONALD FERGUSSON, K.C.B., United Kingdom.
F. L. MCDOUGALL, C.M.G., Australia.
NEVILL L. WRIGHT, F.I.C., New Zealand.
J. M. ADAMS, F.R.C.Sc. (I), Eire.
D. JAMES DAVIES, C.B.E., Newfoundland.
SHAMALDHARI LAL, India.
B. F. WRIGHT, Southern Rhodesia.
J. A. CALDER, Colonies, Protectorates and Mandated Territories.
Sir DAVID CHADWICK, K.C.M.G., C.S.I., C.I.E., *Secretary*.

Director.

Sir GUY A. K. MARSHALL, C.M.G., F.R.S.

Assistant Director and Editor.

Dr. S. A. NEAVE, O.B.E.

Assistant Director and Superintendent of Farnham House Laboratory.

Dr. W. R. THOMPSON, F.R.S.

Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office—41, Queen's Gate, London, S.W.7.

BULLETIN OF ENTOMOLOGICAL RESEARCH

The Imperial Institute of Entomology also publishes the **Bulletin of Entomological Research,** issued quarterly, and containing original articles on Economic Entomology.

The Annual Subscription, *in advance,* is **30s.** post free.

Back Volumes may be obtained as follows :—

Vols. **1–10,** 20s. each;
11–23, 25s. each;
24–29 (1938), 37s. 6d. each, post free.

Orders and subscriptions should be addressed to *The Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.*

—DISINFEST—

IN A

MANLOVE FUMIGATOR

(VACUUM TYPE)

With "Degesch" Patent Circulatory System offers unique advantages in Fumigation.

It is the only system by which the conveniences of Zyklon can be applied to vacuum fumigation.

— Full particulars from —

MANLOVE, ALLIOTT & Co., Ltd.
NOTTINGHAM
London Office: 41 & 42, Parliament St. Westminster, S.W.1

LES INSECTES NUISIBLES AUX PLANTES CULTIVÉES

Leurs Moeurs. Leur Destruction.

Traité d'Entomologie agricole concernant la France, la Corse, l'Afrique du Nord et les régions limitrophes.

Par A. BALACHOWSKY & L. MESNIL.

Tome premier. Insectes nuisibles aux arbres fruitiers, à la vigne, aux céréales et aux graminées des prairies.

Tome second. Insectes nuisibles aux cultures potagères et industrielles, aux plantes d'ornement, à toutes les cultures, aux grains et aux farines. Les insecticides.

Size: 27×21·5 *cm.* Pp. xvi+xi+1921 8 col. plates, 1369 text-figures.

Paris: Etabl. Busson, 1935–36 Price, 2 vols. in paper covers, £2. Postage, Great Britain, 6*s.*; abroad, 9*s.*

Sole Agents for the British Empire and the U.S.A.—
THE IMPERIAL INSTITUTE OF ENTOMOLOGY, 41, QUEEN'S GATE, LONDON, S.W.7.

ENTOMOLOGICAL LITERATURE

LARGEST STOCK IN THE WORLD

of Books, Serials, and Pamphlets, in all Languages, relating to INSECTS, SPIDERS, MITES & TICKS.

CATALOGUES ON APPLICATION

Liberal allowances in cash or exchange will be made for authors' reprints, and other works of entomological interest.

JOHN D. SHERMAN, JR.,
132 PRIMROSE AVENUE, MOUNT VERNON, NEW YORK.

THE

BIOLOGICAL CONTROL OF AN INSECT IN FIJI

An Account of the Coconut Leaf-mining Beetle and its Parasite Complex

BY

T. H. C. TAYLOR, M.Sc.(Lond.)

Royal 8vo, pp. x and 239.

With 23 plates, 2 maps, and 17 text-figures.

Bound in cloth. Price 12s. net.

Postage, inland, 6d.; abroad, 10d.

LONDON
THE IMPERIAL INSTITUTE OF ENTOMOLOGY
41, Queen's Gate, S.W.7
1937

All Rights Reserved.

PYRETHRUM AND DERRIS PREPARATIONS

Stafford Allen & Sons, Ltd., have undertaken original research on Pyrethrum and Derris, and are in a position to supply biologically tested liquid extracts, powders, agricultural insecticides, etc.

ENQUIRIES INVITED.

STAFFORD ALLEN & SONS, LTD.,
Manufacturing Chemists. *Established 1833.*
20–42, WHARF ROAD, CITY ROAD, LONDON, N.1

SCHEDL (K. E.). **Zur Blattwespen-Prognose.** [The Forecasting of Sawfly Infestations.]—*Mitt. Forstwirt. u. Forstwiss.* 1938 pp. 192–241, 25 figs., 82 refs. Hanover, 1938.

In the autumn of 1935, an outbreak of *Diprion* (*Pteronus*) *pini*, L., began in the pine forests in the low lands on the sea coast to the east of Danzig, in territory belonging to the city and to East Prussia. Collections of the cocoons overwintering in the ground were made from 30th March to 28th April 1936, and examination of the material indicated a further increase in infestation.

The different types of holes made in the cocoons by parasites and predators are illustrated. Four species of Tachinids and 21 species of parasitic Hymenoptera were bred from the cocoons, but the total percentage of parasitism was only 4·35 and there was little difference in the percentages for open (empty) and closed cocoons.

Characters are given that serve to distinguish cocoons of the overwintering and summer generations, and in some cases, those of different years; such a distinction is of value in tracing fluctuations in population during the preceding year or two. The diameter of female cocoons is considerably less than that of males, and measurement of cocoons representative of the whole area under investigation showed that females represented 63·3 per cent. of the adults of the first flight period of 1936. Egg-maturation takes place largely in the fully developed female in the cocoon immediately before emergence, so that females taken out of the cocoon give no reliable indication as to fertility. The average number of fully developed eggs in newly emerged females of the first flight period of 1936 was 108·2.

A number of calculations are given regarding population density. This rose suddenly in 1935, reached its peak in the hibernating generation, and then dropped considerably in the two generations of 1936. The collapse of the outbreak in 1936 was chiefly due to mortality in the egg and larval stages. Parasitism of the eggs by *Achrysocharella* (*Tetracampe*) *ruforum*, Krausse, is considered to have been the most important factor, destruction of the larvae by birds coming next. In the cocoon stage, abiotic factors played no observable part in mortality, but of the total number of cocoons collected in spring, 34·02 per cent. had been destroyed by birds, 4·26 by wireworms, 4·04 by mice, 3·76 by a larval disease of unknown origin, 3·42 by Hymenoptera, 1·96 by fungous disease, and 0·93 by Tachinids.

It is concluded that the collection of cocoons, though useful, is of secondary importance for forecasting prospects of infestation, and that the establishment of egg and larval mortality is more reliable. A very small initial population at the beginning of the year can increase extraordinarily in the course of two generations. Birds were of great value in destroying cocoons, and their protection is the only practical measure likely to prevent an outbreak.

BOCZKOWSKA (M.). **Essais de destruction de la punaise de betterave (*Piesma quadrata* Fieb.) par un champignon entomophyte.** [*In Polish.*]—*Roczn. Och. Rośl.* **5** fasc. 5 repr. 23 pp., 5 figs., 9 refs. Puławy, 1938. (With a Summary in French.)

An account is given of laboratory and field experiments carried out in Poland at intervals during the years 1935–37 on the control of *Piesma quadratum*, Fieb., on beet [*cf. R.A.E.*, A **24** 676] by means of a fungus of the genus *Beauveria*, to which the author refers as No. 10.

(588) Wt. P9/3656 1700 3/39 S.E.R. Ltd. Gp. 432. [A] A

In preliminary tests, nymphs and adults infected with spores of the fungus obtained from pure cultures or from various insects were killed within a week. The dead bugs were swollen, and the green colour of the nymphs and young adults had turned to brown. Under humid conditions the insects became covered in 1–2 days with a mould that produced abundant conidia. Nymphs and adults were equally susceptible, and moulting did not affect the process of infection. The effect of humidity on infection was studied with larvae of *Galleria melonella*, L., at 30°C. [86°F.] and nymphs and adults of *Piesma* at 18°C. [64·4°F.]. The larvae of *Galleria* became infected at humidities ranging from 10 to 100 per cent., and there was practically no difference in the rapidity with which infection took place. The nymphs and adults of the bug became infected at 56–100 per cent. humidity. In all cases, however, the fungus fructified only at 100 per cent. humidity. In experiments in which artificially infected bugs were placed in jars or small bags among beet plants, those in the bags died the more quickly, possibly because the temperature in the jars was lower, as water remained in them after rain. The adult bugs were apparently not affected by the water, but many of the nymphs were drowned. When bugs were caged on beet under natural conditions and dusted with spores of the fungus mixed with talc, some were infected and dead eight days later, but the ultimate percentage mortality was not ascertained. Infection proceeded more rapidly in the parts of the plots that were exposed to the sun, but the fungus fructified more quickly in the shadier parts. The dead bugs on plants exposed to the sun became covered with the mould only after abundant rainfall. It also appeared that nymphs could develop and adults oviposit while the fungus was incubating in them. Dusting infested plots of trap beet in May with spores of the fungus mixed with wheat flour at the rate of 0·5 and 200 gm., respectively, to 24 sq. yards considerably reduced the numbers of adult bugs, but did not apparently affect the second generation.

On the basis of these investigations, the author concludes that the fungus could not be effectively used in summer, as it fails to fructify in dry weather and its protracted incubation period allows the appearance of the second generation of the bug. It would be better applied in spring, when the beet plants are small and the bugs are not able to hide among the leaves, or in the autumn, when they should be dusted in their hibernation shelters.

Comptes rendus de la IIIe Conférence du Comité international pour l'Etude en commun de la Lutte contre le Doryphore. Zurich, les 3, 4 et 5 mars 1938.—*Landw. Jb. Schweiz* **52** pt. 6 pp. 682–713. Berne, 1938.

The decisions and recommendations of a technical order adopted at this conference on the Colorado potato beetle, *Leptinotarsa decemlineata*, Say, have already been noticed [*R.A.E.*, A **26** 467]. Reports on its occurrence in 1937 in Germany, Belgium, France, Luxemburg, Holland and Switzerland, and the measures adopted against it, were given by M. Schwarz, R. Mayné, J. Feytaud, V. Ferrant, N. van Poeteren, and G. Bolens, respectively. The following are brief summaries of the papers read.

Feytaud (J.). Sur l'écologie du Doryphore (pp. 698–699). Injury by *L. decemlineata* to potato in France in 1937 was irregular in character

and was almost everywhere due to the spring generation, since the summer generation was adversely affected by dry weather. Damage was severe in some departments in the north-west and south. The influence of soil on infestation was confirmed by the marked differences in attack in neighbouring districts. Observations showed that *L. decemlineata* advanced along valleys and rivers; mountains, though they delay progress, are not likely to be a permanent barrier [*cf.* **25** 498], since in 1937 the beetle was recorded in the Jura and in the valley of the Arc 30 miles from the summit of the Mont Cenis pass. In the Pyrenees it was found at over 3,000 ft. Bittersweet [*Solanum dulcamara*], which is a preferred food-plant, cannot be entirely eradicated.

Feytaud (J.). Les recherches scientifiques actuellement en cours de progrès en France (pp. 699–700). Brief notes are given on recent work on *L. decemlineata* in France that has already been noticed [**24** 639; **25** 592; **26** 368].

Trouvelot (B.). Recherches sur les plantes résistantes au Doryphore (pp. 700–701). From investigations in France made with the collaboration of German workers, it appeared that the varieties of potato generally cultivated in western Europe are all susceptible to infestation, but in varying degree. Further experiments have confirmed the resistance of *Solanum demissum*, and of some hybrids between it and potato, to attack by *L. decemlineata* [*cf.* **24** 190]. Larvae feeding on the leaves of this species ingest smaller daily amounts, so that their development is protracted, and also undergo certain physiological modifications that are not due to under-nourishment.

Schaper (P.). Arbeiten zur züchterischen Bekämpfung des Kartoffelkäfers [Work on the Control of the Potato Beetle by Plant Selection] (pp. 701–703). In experiments in which larvae of *L. decemlineata* were fed on wild species of *Solanum* [*cf.* **24** 77, 190], very few reached the pupal stage on *S. demissum*, *S. polyadenium*, *S. henryi* or *S. jamesii*, and of these none gave rise to an adult. A considerable degree of resistance to infestation was shown by four other wild species, including *S. chacoense*, and by hybrids between potato and *S. demissum* or *S. chacoense* [*cf.* **25** 648]. In the discussion, Trouvelot stated that females oviposited preferably on the leaves of plants in poor condition, and Schaper considered that plants with a severe virus infection developed slowly and afforded better conditions for breeding.

Feytaud (J.). Quelques remarques sur les ennemis naturels (pp. 703–705). The chief natural enemies of *L. decemlineata* in France are the predacious larvae of Chrysopids, and the Pentatomids, *Zicrona coerulea*, L., and *Auriga* (*Arma*) *custos*, F. [*cf.* **25** 106]. Work on the breeding and distribution of introduced predators has already been noticed [*cf.* **26** 594, 595].

Feytaud (J.). Le Doryphore et les engrais (pp. 705–706). Work indicating that the addition of calcium cyanamide to the soil causes some mortality of pupating larvae of *L. decemlineata* [**26** 412] is recapitulated. M. Schwarz stated that in experiments in 1936–37 against various stages of the beetle on the plant and in the soil, calcium cyanamide acted as both a contact and a stomach poison.

Mayné (R.). Que faut-il entendre par foyer du Doryphore? (pp. 707–708). It is suggested that the term "focus of infestation" should be restricted to centres where the beetle is actively breeding and larvae are present. Places where one adult, or one adult with one batch of eggs, has been found should be referred to as suspect.

[Ponomarenko (D. A.).] **Пономаренко (Д. А.). Pests of Lucerne grown for Seed and their Control.** [*In Russian.*]—*Soc. Grain Fmg* 1938 no. 1 pp. 134–152. Saratov, 1938.

Much of the information in this account of the principal pests of lucerne in the south-east of European Russia, and the methods of controlling them, has been noticed from a summary [*R.A.E.*, A **26** 76]. Those dealt with are the weevils, *Sitona callosa*, Gylh., *S. inops*, Gylh., *S. cylindricollis*, Fhs., *Tychius flavus*, Beck., *T. femoralis*, Bris. [*cf.* **22** 588], *T. junceus*, Reich, and *Hypera* (*Phytonomus*) *transsylvanica*, Petri, and the Eurytomid, *Bruchophagus gibbus*, Boh. [*cf.* **22** 587].

The species of *Sitona* are of importance as pests only at the beginning of the vegetation period, and cannot then be reached by stomach poisons, as they feed chiefly on sprouting plants that are still covered with small particles of soil. Less injury is caused if the lucerne is sown early, or cultivated at some distance from fields that were used for leguminous crops during the preceding year. In one locality, lucerne in a field that had been under wheat completely escaped infestation, and in another, the use of manures that promoted the simultaneous appearance of the sprouts and increased their vigour reduced considerably the percentage of severely infested plants.

T. junceus occurs only on irrigated lands and causes serious damage only to lucerne that has been cultivated for several consecutive years and is grown for seed after the second mowing.

Hypera transsylvanica has one generation a year. The overwintered weevils, which become active as soon as lucerne begins to grow in the spring, feed on the green parts of the plants and oviposit in the stems and stipules. The young larvae penetrate into the flower buds and destroy the unopened inflorescences ; in later instars they feed on the leaves and open inflorescences. The larvae are most abundant in May and the beginning of June, after which their numbers sharply decline. They pupate in cocoons on the tips of the stems, and the young weevils feed voraciously on the stems and leaves for a few days and then enter the soil or shelter under litter until the following spring. In several localities in 1937, the larvae destroyed 82–98 per cent. of the buds, so that the lucerne did not flower, though otherwise it showed no signs of infestation. Lucerne is practically not infested during the first two years of its growth, but the weevil gradually increases in abundance if cultivation is continued for several years. The adults are not capable of rapid migration, and only a few wander to new fields from adjoining lucerne. Maximum loss is caused to old lucerne grown for seed after the first mowing. Periodical mowing for hay during the whole period of growth considerably reduces infestation. Dusting lucerne in spring when the stems are about 1½ ins. high with calcium arsenite at the rate of 9 lb. per acre kills practically all the weevils, but if it is windy or the temperature falls below 12°C. [53·6°F.], they cease feeding and dusting should be repeated. Dusting with calcium arsenate and sodium fluosilicate at rates of 13½ and 18 lb. per acre, respectively, killed 90 and 86 per cent. of the weevils. Larvae feeding on open flowers or leaves can be controlled by two applications of dust, the first before the inflorescences appear and the second 6–8 days later ; single applications of calcium arsenate and sodium fluosilicate at rates of 9 and 18 lb. per acre, respectively, gave percentage mortalities of up to 99 and 80. Wild lucerne growing near cultivated fields should

be destroyed, and lucerne grown for fodder should be mown at the beginning of flowering, dried and gathered in as soon as possible so as to kill the larvae before they pupate, after which drying does not affect them.

[Sakharov (N. L.).] **Сахаров (Н. Л.). On the local Races of *Trichogramma* and Laboratories for breeding *Trichogramma* on collective Farms.** [*In Russian.*]—*Soc. Grain Fmg* 1938 no. 1 pp. 164–168. Saratov, 1938.

The author points out that in work on the distribution and breeding of *Trichogramma* [*evanescens*, Westw.] in the Russian Union, it is the Caucasian race of the parasite that is used, the females of which oviposit very unwillingly in eggs of the cabbage butterfly [*Pieris brassicae*, L.]. Other races of the parasite, however, occur in various parts of the Union, including two in the Province of Astrakhan. Observations in 1937 showed that one of the latter gave almost 100 per cent. mortality of the eggs of the cabbage moth [*Barathra brassicae*, L.], and 70 per cent. of those of the small cabbage butterfly [*Pieris rapae*, L.] and destroyed a large number of eggs of the codling moth [*Cydia pomonella*, L.], while the other, discovered in 1938, parasitised eggs of the meadow moth [*Loxostege sticticalis*, L.] and the corn borer [*Pyrausta nubilalis*, Hb.]. In 1937, a further race of *Trichogramma* was discovered in the Province of Saratov, parasitising 22 per cent. of the eggs of *Cydia* (*Laspeyresia*) *nigricana*, Steph. It is suggested that these local races should be bred in the parasite laboratories and utilised for the control of pests, as they might prove more suited to local climatic conditions than is the Caucasian form.

[Zakharov (L. Z.).] **Захаров (Л. З.). Breeding Areas of the Asiatic Locust in eastern and central Manuich and their Eradication.** [*In Russian.*]—*Social. Grain Fmg* 1938 no. 2 pp. 90–109, 1 map, 1 diagr., 23 refs. Saratov, 1938.

A description is given of the topography, hydrographical conditions, climate and vegetation of breeding areas of *Locusta migratoria*, L., along the course of the Manuich depression, which extends between the lower reaches of the river Don and the Caspian Sea. Although some of the areas serve for permanent breeding of local locusts, their importance is enhanced by the fact that they are situated on the usual migration routes of swarms bred on the shores of the Caspian Sea and driven north-westwards by the prevailing winds. Such swarms find extensive areas suitable for breeding in the Manuich depression, and their progeny usually penetrate farther westwards in the following year. Most of the breeding areas on the Manuich are accessible, and the need of keeping them under control is strongly urged.

Eichler (W.). **Lebensraum und Lebensgeschichte der Dahlemer Palmenhausheuschrecke *Phlugiola dahlemica* nov. spec. (Orthopt. Tettigoniid.). (Studien zur deutschen Gewächshausfauna I.)** [The Biotope and Biology of the Dahlem Palm House Grasshopper, *P. dahlemica*, sp. n. Studies on the German Greenhouse Fauna I.] —Inaug.-Diss. Friedr.-Wilh.-Univ. Berlin, 79 pp., 12 figs., 64 refs. Neubrandenburg, 1938. (Repr. from *Dtsch. ent. Z.* 1938.)

An account is given of the morphology, life-history and habits of *Phlugiola dahlemica*, sp. n., which was found in the hot-houses of the

Berlin Botanical Gardens, where it feeds on various minute insects. It is the Tettigoniid previously erroneously identified as *P. redtenbacheri*, Karny [*cf. R.A.E.*, A **15** 227]; the fact that it reproduces parthenogenetically was confirmed, and no males were found.

BÖNING (K.). **Die wichtigsten Krankheiten und Schädlinge des Meerrettichs.** [The chief Diseases and Pests of Horse-radish.]—*Nachr. SchädlBekämpf.* **13** no. 2 pp. 62–87, 27 figs., 11 refs. [Leverkusen] June 1938. (With Summaries in English, French and Spanish.)

In the second part of this paper, the author gives brief notes on the bionomics and morphology of the principal insect pests of horse-radish in Germany. Of these, the larvae and adults of the Chrysomelids, *Phaedon armoraciae*, L., and *P. cochleariae*, F., cause serious injury to the leaves [*cf. R.A.E.*, A **21** 396], which are also sometimes attacked by larvae and adults of *Galeruca tanaceti*, L. This polyphagous Galerucid has two generations during the summer and overwinters in the egg stage. Flea-beetles of the genus *Phyllotreta* cause considerable damage to the leaves in spring. They usually have one generation a year, but a second occasionally develops in hot dry summers. The species concerned are *P. armoraceae*, Koch, which is confined to horse-radish, the larva boring in the leaf-stalks, but is not abundant enough to be of importance, and *P. nemorum*, L., *P. undulata*, Kutsch., *P. cruciferae*, Gze, and *P. atra*, F., which also attack other crucifers [*cf.* **16** 616, etc]. The cabbage flies, *Hylemyia* (*Chortophila*) *brassicae*, Bch., and *H.* (*C.*) *floralis*, Fall., are comparatively common on horse-radish. Their larvae mine the leaf-stalks, but do very little damage. Other pests that occasionally cause injury include the larvae of *Scaptomyza flaveola*, Mg., and *Phytomyza rufipes*, Mg. (*ruficornis*, Zett.), which feed on the leaves, *Pieris brassicae*, L., of which the second-generation larvae feed on the leaves, *P. rapae*, L., *P. napi*, L., the sawfly, *Athalia rosae*, L. (*spinarum*, F.), Lamellicorn larvae, wireworms, cutworms and *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.).

ESCHERICH (K.). **Bemerkungen zur Hausbockstatistik.** [Remarks on Statistics on *Hylotrupes bajulus*.]—*Anz. Schädlingsk.* **14** pt. 10 pp. 113–116. Berlin, 15th October 1938.

The author discusses some points in a report of an official survey of buildings in Germany for ascertaining infestation by *Hylotrupes bajulus*, L. [*cf. R.A.E.*, A **26** 599; **27** 6]. He considers that the great and irregular differences in rate of infestation recorded must be due in part to differences in the ways in which the records were obtained. The reasons for the great increase of infestation in recent years are not fully known. House owners should be compelled to undertake measures for control. The greatest mortality seems to be ensured by the hot-air process, by means of which the timber in a building is heated to a point fatal to the larvae [**21** 214], but painting the woodwork with a suitable insecticide, such as Xylamon [**25** 658], not only kills the larvae, but also prevents reinfestation.

PETERS (G.). **Die biologisch-chemische Eignungsprüfung gasförmig wirkender Insektizide.** [The biological-chemical Examination of the Value of Fumigant Insecticides.]—*Anz. Schädlingsk.* **14** pt. 10 pp. 116–122, 9 graphs. Berlin, 15th October 1938.

The author emphasises the desirability of discovering fumigants of greater toxicity to insects and less dangerous to man than those in current use and discusses modern methods of testing gases for reliability [*cf. R.A.E.*, A **26** 633]. As well as the usual physical and chemical tests, biological tests must be carried out in the laboratory on a sufficient number of insects. As biotic processes are involved in the relation between insect and insecticide, exact figures cannot be obtained, and even average values and estimates of probability are not always easy to ascertain. As examples of methods of comparing fumigants, graphs are reproduced showing the time-concentration curves obtained with various gases acting on various insects. It is shown that the character of the curve for a given gas differs considerably according to the species, or in some cases even the stage of the insect under test. There would thus seem to be specific fumigants for each group of pests [*cf.* **25** 768]. The curves given show that the effect of ethylene oxide, which is a cell poison, is governed by temperature in quite a normal way, being favoured by warmth and checked by cold. The effect of hydrocyanic acid gas, a respiratory poison, is reduced at high temperatures owing to respiration-shock. Meth-allyl-chloride, an irritant poison [*cf.* **22** 90], is as effective at a low temperature as at a high one. The author concludes by pointing out that reliable apparatus is essential if investigations are to give results of value.

JANCKE [O.]. **Ueber den Frass von Heu- und Sauerwürmern an Rebblättern.** [On the Feeding by the Spring and Summer Generations of Vine Moths on Vine Leaves.]—*Dtsch. Weinbau* **17** pt. 32 pp. 475–476, 2 figs. Mainz, 7th August 1938.

Though *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., are serious pests of vines in Germany, many growers are still ignorant of the fact that the larvae of both the spring and summer generations can develop on the leaves as successfully and as rapidly as on the inflorescences and grapes. Notes are given on the appearance of leaves on which larvae have been feeding; the injury done in this way is not of economic importance.

JANCKE [O.]. **Laboratoriumsprüfung von Mitteln gegen den Traubenwickler.** [Laboratory Tests of Insecticides against the Vine Moth.]—*Umschau* 1938 pt. 13 repr. 4 pp., 3 figs., 2 refs. Frankfurt a.M., 1938.

In connection with investigations on the control of the vine moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., a description is given of a technique, which has already been noticed [*cf. R.A.E.*, A **26** 4], for breeding the moths in the laboratory so as to obtain uniform test material. The sprays and dusts to be tested are applied either directly to the larvae, which are then placed on fresh vine leaves, or to vine leaves on which larvae are subsequently allowed to feed.

Gösswald (K.). **Ueber die Widerstandsfähigkeit von Ameisen-Weibchen gegen Arsenfrassgifte. I.** *Lasius niger niger* **L., schwarzgraue Wegameise.** [On the Resistance of Female Ants to Arsenical Stomach Poisons. I. *L. niger niger*, L.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 197–220, 11 refs. Berlin, 11th October 1938.

In further investigations in Germany on the resistance of ants to poisons, tests were made, with the same two arsenical baits as were previously used [*cf. R.A.E.*, A **26** 716], on females of *Lasius niger*, L. The oviparous females have large amounts of reserve substances that render them more resistant to poisons than are the workers, and a colony cannot be destroyed unless the poison used kills the queen.

Schuch (K.). **Ueber den Einfluss der Feuchtigkeit auf das Eistadium des Maikäfers** (*Melolontha melolontha* **L.**). [On the Influence of Humidity on the Egg Stage of the May Beetle, *M. melolontha*.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 220-225, 9 refs. Berlin, 10th October 1938.

In this paper are given the results of investigations in Germany on the relation of humidity to development of the eggs of *Melolontha melolontha*, L., the volume of which was shown to increase over three times in 21 days, owing, presumably, to the absorption of water. The eggs required a marked degree of moisture in their environment, and they developed normally only when they were in direct contact with a moist substratum that permitted access of air. If air saturated with humidity was the only source from which the eggs could absorb moisture, there was an increase in mortality and the newly hatched larvae were much shrivelled and notably lighter in weight than normal ones. On the other hand, eggs kept under water were gradually killed, presumably because of interference with their gaseous metabolism.

Speyer (W.). **Ueber die Zusammenhänge zwischen Begattung, Befruchtung und Eiablage beim Kleinen Frostspanner** (*Cheimatobia brumata* **L.**). [On the Connections between Pairing, Fertilisation and Oviposition in the Lesser Winter Moth, *Operophtera brumata*, L.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 226–228. Berlin, 10th October 1938.

The author reviews the possible causes of the deposition of unfertilised eggs by females of *Operophtera* (*Cheimatobia*) *brumata*, L., and describes investigations on pairing, fertilisation and oviposition in this moth which show that the fertility of the males and females varies in the different local races that occur in Germany [*cf. R.A.E.*, A **26** 420 ; **27** 99].

Thiem (H.). **Ueber Bedingungen der Massenvermehrung von Insekten.** [On Conditions governing the Mass Increase of Insects.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 229–255, 10 figs., 6 refs. Berlin, 10th October 1938.

The author discusses with respect to *Phylloxera vitifoliae*, Fitch (*vastatrix*, Planch.) and *Lecanium* (*Eulecanium*) *corni*, Bch., the theory that mass infestation of plants by insect pests is a function of favourable conditions of climate and food. *P. vitifoliae* infests the grape-vine,

Vitis vinifera, throughout Europe, without regard to the age, physiological condition or mode of cultivation of the plants, but the infestation of its food-plants by *L. corni* varies very markedly, even in a single region. Welsch considers that soil conditions influence infestation by *L. corni* [*R.A.E.*, A **26** 251], so that a mass increase of this Coccid is a function of soil-ecological factors favourable to it, and Mahdihassan has recognised factors that predispose trees to infestation by lac insects [**24** 740].

In the case of *L. corni*, some species of plants are never severely infested, while others are not severely infested under certain conditions. The author proposes the terms geno-immune for the former and pheno-immune for the latter. The danger of outbreaks of this Coccid that results from monoculture could be very much reduced if the plants could be rendered pheno-immune by growing them in a particular situation or by soil cultivation.

HADERSOLD (O.). **Ergebnisse von Parasiten-Zuchten der Zweigstelle Stade der Biologischen Reichsanstalt für Land- und Forstwirtschaft. II. Teil : Braconidae.** [The Results of Rearing Parasites at the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 261–269, 1 fig., 4 refs. Berlin, 10th October 1938.

This list of 22 Braconids bred since 1926 from insects attacking fruit and other trees and plants at Stade in the Lower Elbe region is similar in character to the list of Ichneumonids [*R.A.E.*, A **26** 420].

ABRAHAM (R.). **Kartoffelkäferlarven auf Tomaten.** [Potato Beetle Larvae on Tomato.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 270–272, 5 figs. Berlin, 10th October 1938.

Near Heidelberg, the author observed Aphids, flies, Psyllids and a bug, *Aradus cinnamomeus*, Panz., held on the stems of tomato plants, their tarsi being gummed by a secretion from the glandular hairs. He then placed larvae of *Leptinotarsa decemlineata*, Say, on the plants and found that the secretion adhered to the legs and mouthparts of first-instar larvae, which were hardly able to move after an hour, but did not adhere to fourth-instar larvae. He suggests that the presence of glandular hairs should be noted in examining plants to ascertain if they are suitable for *L. decemlineata*.

HENNIG (W.). **Zur Nomenklatur pflanzenschädlicher Anthomyiiden.** [Regarding the Nomenclature of Anthomyiids injurious to Plants.] —*Arb. physiol. angew. Ent. Berl.* **5** no. 3 pp. 279–284, 11 refs. Berlin, 10th October 1938.

The object of this paper is to obtain uniformity in the nomenclature of Anthomyiids that are injurious to economic plants, largely by rendering widely available the views of Séguy as shown in a recent catalogue of the family [*Genera Insectorum*, vol. 205]. A list, arranged by food-plants, is given of the injurious species placed by Séguy in the genus *Hylemyia* ; it shows which of the species were also recorded in Sorauer's handbook [*R.A.E.*, A **20** 48], in which some of them were referred to the genera *Anthomyia* and *Chortophila*. The nomenclature of certain species about which divergent views exist is discussed separately on the basis of data indicated by Séguy.

As regards the genera, the author considers that the practical course is to interpret *Hylemyia* in the wide sense used by Séguy. Particular confusion has arisen from attempts to separate *Phorbia* and *Chortophila* from it, as the identity of the genotype of *Phorbia* is uncertain. Thus *Chortophila* has been considered identical with *Phorbia*, or alternatively its genotype has been attributed to *Phorbia* while it has itself been used to include another group of species.

Schmidt (H.). **Schädliche Blattwespen an Obstbäumen und Beerensträuchern.** [Injurious Sawflies on Fruit Trees and Berry Bushes.] —*Kranke Pflanze* **15** pt. 10 pp. 169–173, 2 figs. Dresden, October 1938.

In Saxony, gooseberries and currants are often defoliated by the larvae of *Nematus* (*Pteronidea*) *ribesii*, Scop., which has 2–3 generations a year and sometimes a fourth. Adults from overwintered larvae appear in April, and females deposit 65–100 eggs in slits in the ribs of the leaves. The larvae hatch in 8–10 days and begin feeding on the leaves; the unripe fruits of gooseberry are also often attacked. The larvae feed for 3–4 weeks and then enter the soil for pupation. New adults appear in June–July and again at the end of August. All larvae of the last generation and some of those of the earlier ones overwinter in the soil and pupate in spring. *N. ribesii* reproduces parthenogenetically in the absence of males, mostly late in the season, the progeny being exclusively male.

The bionomics of *Priophorus pallipes*, Lep. (*padi*, auct.) are similar; the larvae feed chiefly on the undersides of the leaves of cherry and other species of *Prunus*. Adults appear in May, June–July, and September–October. *Caliroa* (*Eriocampoides*) *limacina*, Retz., also attacks cherry and plum, as well as other deciduous trees. It usually has one generation a year, the adults occurring in May–June, but adults of a second generation sometimes appear in July–August. *Neurotoma flaviventris*, Retz., feeds chiefly on pear, which is sometimes completely defoliated, and occasionally on stone-fruits and hawthorn [*Crataegus*]. The adults appear in May–June, and the females lay about 200 eggs, in batches of 30–60, on the lower surface of the leaves. The larvae hatch in 7–10 days and feed gregariously in web nests, spinning about six in the course of the summer. In June–August they drop individually to the ground and hibernate. Pupation occurs in spring, but some of the larvae remain in diapause and hibernate a second time.

Thiem (H.) & Sy (M.). **Ueber die Bedeutung der Vernichtung des Apfelwicklers durch Vögel.** [On the Importance of the Destruction of *Cydia pomonella* by Birds.]—*NachrBl. dtsch. PflSchDienst* **18** no. 11 pp. 95–97. Berlin, November 1938.

Examinations of apple and pear trees in districts near Berlin in the autumn of 1937 and the spring of 1938 showed that tits and other birds had destroyed large numbers of the larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., hibernating under trap bands and on the trunks and branches. In many cases, and particularly where nesting boxes had been provided, over 90 per cent. of the larvae had been destroyed by the spring. There were, however, a great many refuges inaccessible to birds, and these should be eliminated where possible.

FISCHER (W.). **Ueber die an Calciumarsenate zu stellenden Anforderungen.** [On the Standards required of Calcium Arsenates.]—*NachrBl. dtsch. PflSchDienst* **18** no. 11 pp. 97–99. Berlin, November 1938.

The author gives the results of analysis of a number of samples of calcium arsenate and recommends the following standards for calcium arsenates to be used in Germany in 1939: The arsenic content should be 25±0·5 per cent. As; the content of water-soluble arsenic compounds should not exceed 1·5 per cent. As_2O_5; and at least 70, 55 and 50 per cent. of the calcium arsenate should be in the upper nine-tenths of a 0·4 per cent. aqueous suspension after it has stood for 5, 15 and 30 minutes, respectively. The method of testing for the standard of suspension is described.

MALENOTTI (E.). **La psilla del pero.** [The Pear Psyllid.]—*Note Fruttic.* **16** no. 11 pp. 174–176. Pistoia, 1st November 1938.

Brief notes are given on the bionomics of *Psylla pyricola*, Först., a pest of pear that is very difficult to control. In Italy, it has five or more generations a year. As the adults overwinter on other trees as well as on pear, the first spray should be applied in February–March when they appear at the base of the pear buds to oviposit. For this spray a good tar-distillate is effective. Subsequent infestation may be reduced by a spray containing 0·3 per cent. nicotine sulphate and 0·7 per cent. soft soap or by some proprietary insecticides.

WILSON (G. F.). **The Glasshouse Leaf-hopper, *Erythroneura pallidifrons* Edw.**—*J. R. hort. Soc.* **63** pt. 10 pp. 481–484, 2 pls., 8 refs. London, October 1938.

In view of the increasing importance of *Erythroneura pallidifrons*, Edw., as a pest of greenhouse plants in Britain, data on its identity and bionomics are reviewed [*R.A.E.*, A **20** 333] and all stages are described. A list is given of its chief food-plants, which comprise 30 cultivated plants and 3 weeds, indicating the degree to which they are infested. It is especially injurious to forced mint, *Primula* spp. and tomato; tomato seedlings may be destroyed by a severe early attack. It breeds continuously under greenhouse conditions and has often been observed to overwinter on chickweed (*Stellaria media*) in empty houses. The Mymarid, *Anagrus atomus*, L., which attacks the eggs and is the only known parasite, has so far proved unsatisfactory in controlling infestations.

Eradication of this Jassid from heavily infested greenhouses is difficult. It is not controlled by repeated fumigation with nicotine or with hydrocyanic acid gas at concentrations suitable for houses of mixed plants, and both adults and nymphs are very resistant to sprays. Moreover, it is difficult to spray the lower surface of the leaves of pot plants, though they can sometimes be effectively treated by immersion. The best control is obtained by dusting with nicotine, but the dust renders the foliage unsightly for some time. Two or three thorough applications, at ten-day intervals, of a spray of ¾ fl. oz. nicotine and ¾ lb. soft soap in 10 gals. water is of considerable value; sprays containing derris, pyrethrum extract or eucalyptus oil are much less effective. Infestation may sometimes be checked by removing the lower infested leaves of plants and crushing the insects on the upper leaves. Weeds in and near glasshouses should be destroyed to prevent the winter survival of the leafhopper.

WRIGHT (D. W.). **The Control of the Cabbage Root Fly** (*Delia* (*Hylemia*) *brassicae*, **Bouché**).—*J. Ministr. Agric.* **45** no. 8 pp. 812–820, 2 pls., 4 refs. London, November 1938.

An account is given of the bionomics of *Hylemyia* (*Delia*) *brassicae*, Bch., in England and the injury it causes to cruciferous vegetables [*cf. R.A.E.*, A **15** 648]. Experimental work on control in various countries is discussed. Poison baits to kill the adults do not seem promising, as no bait has been found that is sufficiently lasting and attractive [*cf.* **24** 7]. The deposition of eggs in the soil near the plants has been largely prevented by placing tarred felt disks round the stems, in contact with the soil [*cf.* **20** 255, etc.], but they could be used only on very small holdings owing to expense. The application round the plant of a bitumen emulsion, which forms a hard crust on setting, has also been said to give considerable control [**25** 132]. In Britain, naphthalene and chlor-cresylic acid have been the most effective of the repellents tested to prevent oviposition, but both have given very variable results and have to be renewed frequently; the author found that flaked naphthalene, applied at the rate of 200 lb. per acre, may disappear in five days under dry, warm conditions.

Of insecticides tested against the larvae, certain mercury salts are the most effective, and watering the plants with a solution of 1 oz. mercury bichloride in 8 or 10 gals. water, applied at the rate of $\frac{1}{4}$ pint per plant, has given good results and has been widely recommended. Mercury bichloride is highly poisonous, however, and injures the plants if the solution is too strong; 1 oz. in 8 gals. is safe for most crucifers, but 1 in 10 should be used for cauliflowers. It has recently been shown that mercurous chloride, which is not poisonous to man and does not injure plants, is very effective as a soil insecticide against root maggots. In experiments against *H. brassicae* in eastern England in 1938, cauliflowers set out on 5th May were treated with a solution of 1 oz. mercury bichloride in 10 gals. water at the rate of $\frac{1}{4}$ pint per plant on 7th, 17th and 27th May, or with a 4 per cent. mercurous chloride dust, applied with a hand duster of the bellows type where the stem entered the soil, at a rate of 2·8 gm. per plant on 7th and 20th May or on 7th May only. The percentages of plants attacked were 35·2, 5·6 and 30·3, respectively, in comparison with 94·9 on the controls. Treatment with mercurous chloride was considerably cheaper than that with mercury bichloride, and did not appear to hinder growth. It appears, therefore, that two applications of a 4 per cent. mercurous chloride dust is the most effective treatment. The rate of application tested is equivalent to 30 lb. per acre for plants 1 yard apart. On early transplanted crucifers on light soils in the eastern counties, the first application should be made at the beginning of the last week in April and the second a fortnight later; they could be delayed for a week on the heavier soils in this area. Plants set out later in the year should receive the first treatment within four days, preferably on the second or third day. The dust should be forced into the crack that develops between the stem and the surrounding soil.

HUGGINS (H. C.). *Pyrausta nubilalis* **Hübner** (**Lep., Pyralidae**) **in South Essex.**—*Entomologist* **71** no. 906 pp. 241–242. London, November 1938.

Several adults of *Pyrausta nubilalis*, Hb., were taken on mugwort [*Artemisia vulgaris*] in Essex in July 1938; some of the females

oviposited, and the larvae from one batch of eggs fed on growing maize plants. A complete record is given of former captures of this moth in England and Wales; it is only a casual immigrant, and the adults taken in Essex were presumably all the progeny of a single female that had oviposited on the mugwort.

Plantesygdomme i Danmark 1937. . . . Plant Diseases and Pests in Denmark 1937.—*Tidsskr. Planteavl* **43** pp. 222–278, 2 figs.; also as *Overs. St. Plantepat. Forsøg* no. 54. Copenhagen, 1938. (With a Summary in English.)

This report includes a section (pp. 259–274) by P. Bovien on the principal pests of cultivated plants in Denmark in 1937. *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., now occurs on apple throughout the country, and it is hoped that the parasite, *Aphelinus mali*, Hald., which has been introduced from Germany for its control, may become established. Observations on *Cydia* (*Carpocapsa*) *pomonella*, L., [*cf. R.A.E.*, A **25** 766] showed that the emergence of the adults lasted from 27th May to 14th June. Oviposition on apple trees began on 8th June, and of 79 eggs deposited on that date, 48 were on the upper surfaces of the leaves, 20 on the lower surfaces and 11 on brown twigs. Some eggs were deposited on young fruits at the end of June, when their skins had become smooth. Larvae hatched from 14th June to 20th July, 80 per cent. having done so by 6th July. Only one generation occurred. Other pests of fruit included the Carabid, *Harpalus rufipes*, DeG. (*ruficornis*, F.), attacking strawberries, *Hoplocampa testudinea*, Klug, which damaged up to 75 per cent. of the apples in some localities, and *H. minuta*, Christ (*fulvicornis*, F.), against which sprays of derris or quassia were effective, on plums.

Beet in Sleswig was attacked by adults of *Atomaria linearis*, Steph., and larvae of *Melolontha melolontha*, L. (*vulgaris*, F.). In one field, 29 per cent. of the latter were parasitised by the Tachinid, *Dexia rustica*, F. Severe injury to cabbage, swedes and turnips, and locally to radishes, was caused by *Athalia rosae*, L. (*spinarum*, F.), and swedes, turnips and beet in Jutland were attacked by *Cneorrhinus plagiatus*, Schall. Cauliflowers in one locality were seriously damaged by *Cidaria fluctuata*, L. Pests of wheat included the larvae of a species of *Helophorus*, possibly *H. nubilus*, F., *Cephus pygmaeus*, L., which also attacked barley, *Luperina* (*Apamea*) *testacea*, Schiff., and *Tipula paludosa*, Mg. *Bibio hortulanus*, L., caused considerable damage to barley following root crops, especially in fields that had been heavily manured in spring, and *Oscinella* (*Oscinis*) *frit*, L., injured wheat and rye following grass.

Notini (G.). **Undersökningar rörande på rödklöver levande spetsvivlar (*Apion* Herbst). 2. Ekologiska undersökningar.** [Investigations on Red Clover Weevils (*Apion*, Hbst.). 2. Ecological Investigations.]—*Medd. Växtskyddsanst.* no. 22, 42 pp., 14 figs., 21 refs. Stockholm, 1938. (With a Summary in German.)

In the first part of this paper, the author states that observations on the distribution of the weevils, *Apion apricans*, Hbst., and *A. aestivum*, Germ., on red clover [*Trifolium pratense*] in Sweden [*cf. R.A.E.*, A **23** 625], including investigations in over 400 localities, showed that *A. apricans* occurs throughout the country, but that *A. aestivum* is restricted mainly to the southern coastal regions, which

are characterised by low atmospheric humidity. High humidity limits the distribution of the latter species indirectly, by favouring the development on the overwintering weevils of the entomophagous fungi, *Metarrhizium anisopliae* and *Penicillium brevicompactum*. The latter does not appear previously to have been recorded as a parasite of insects. In experiments, 200 examples of *A. aestivum* were placed in October 1935 in jars containing a layer of plaster of Paris on which was poured 10 cc. of a suspension in water of crushed weevils infested by fungi. The jars were kept at a temperature of 8–9·1°C. [46·4–48·38°F.], at which the weevils usually hibernate. After 33 days, 60–100 per cent. of the weevils were dead and infested by fungi, while only 6–14 per cent. were dead in controls. The fungi gave complete mortality of 368 hibernating weevils, kept at 100 per cent. humidity, in 3 days. In a test on 120 newly emerged weevils of each species, fed on clover leaves and kept in jars containing plaster of Paris soaked in a suspension of the conidia of *M. anisopliae*, the percentage mortality after about 4 months was 29·2 for *A. apricans* and 90·8 for *A. aestivum*. In a similar test with *P. brevicompactum*, the average percentage mortalities in *A. apricans* and *A. aestivum* after 24 days at room temperature (18–20°C. [64·4–68°F.]) were 12 and 72, respectively. The infection was transmitted to either species by conidia from dead examples of the other. In all the tests, mortality was greater and the fungi developed more quickly in *A. aestivum* than in *A. apricans*.

In the second part of the paper, the structure and development of the inflorescences of various types of red clover are discussed in detail in relation to infestation by *Apion*. The larvae were able to penetrate into those having comparatively few florets on a long receptacle more easily than into those in which the florets were dense and more crowded. Larvae that penetrated to the base of the inflorescence caused twice as much injury as those that fed only at the top.

MATHLEIN (R.). **Undersökningar rörande förrådsskadedjur. I. Kornviveln, *Calandra granaria* L. och risviveln, *Calandra oryzae* L. Deras biologi och bekämpning.** [Investigations on Pests of stored Products. I. *C. granaria* and *C. oryzae*. Their Biology and Control.]—*Medd. Växtskyddsanst.* no. 23, 91 pp., 8 figs., 60 refs. Stockholm, 1938. (With a Summary in German.)

In this paper, which is the first of a series on the pests of stored products in Sweden, the author discusses, from the literature and original observations, the morphology, biology, natural enemies and control of *Calandra granaria*, L., and *C. oryzae*, L., in stored grain. *C. granaria* occurs throughout southern Sweden as far north as Stockholm and is acclimatised, whereas *C. oryzae*, which is introduced every year in imported grain, causes much injury during the summer, but dies out in winter.

The following is based mainly on the author's summary of his own observations, carried out near Stockholm: The minimum times required by *C. granaria* for development from oviposition to adult emergence at temperatures of 17, 23·5 and 14–16°C. [80·6, 74·3 and 57·2–60·8°F.] were 29, 38 and 113 days. At normal room temperature in summer, development in both species required about two months,

the egg, larval and pupal stages lasting about 7, 40–50 and 8–10 days, respectively. Development was less dependent on the moisture content of the grain than on temperature, but was considerably prolonged when this content was very low. Pairing did not occur below 12°C. [53·6°F.] in *C. granaria*, or below 12·5°C. [54·5°F.] in *C. oryzae*, and their lower limits for oviposition were 13 and 14°C. [55·4 and 57·2°F.], respectively. The preoviposition period in *C. granaria* at 25, 16–18 and 12·5–14·5°C. [77, 60·8–64·4 and 54·5–58·1°F.] lasted 5, 20–25 and 70–80 days, respectively, while in *C. oryzae* at the first two temperatures it lasted 4 and 10 days. The temperature in southern Sweden generally remains high enough for egg-maturation in the latter species up to September, so that females that emerge in late summer often mature eggs. Observations showed that the lowest moisture content in grain that permitted development and oviposition was a little under 10 per cent., both species reproducing normally in wheat when the moisture content was 9·9 per cent. but scarcely at all when it was 9·5 per cent.

In experiments on feeding and oviposition preferences [*cf. R.A.E.*, A **24** 742], 50 adults of *C. granaria* were placed in each of 4 jars containing 2,000 mixed grains. In 3 jars these were equal parts of wheat, rye, unhusked barley and unhusked oats, while in the fourth they were the same, but the oats had been husked. All the jars were kept at 23–24°C. [73·4–75·2°F.]. A similar test was made with *C. oryzae*. The grains were examined after a month for signs of attack and were then kept a further six weeks for the eggs in them to hatch. The results showed that wheat was the most readily eaten, and was followed in order of preference by barley and maize. Unhusked oats were very little attacked by either species, but *C. oryzae* preferred husked oats to all the others, and *C. granaria* ate them readily. Most larvae of *C. granaria* were found in wheat and maize, none in unhusked oats, and very few in husked oats. Altogether, larvae of *C. oryzae* were more numerous than those of *C. granaria*; over 50 per cent. occurred in rye, 35 per cent. in wheat, 7–11 per cent. in maize and less than 1 per cent. in unhusked oats. Husked oats, however, contained as many larvae as did wheat. When 100 adults of *C. granaria* were placed in each of 4 jars, of which 2 were empty and 2 contained peas, and kept at room temperature and about 70 per cent. relative humidity, all the weevils in the peas were dead by the 38th day, whereas 1 per cent. were still alive on the 42nd day in the empty jars. In another test, adults of both species were kept without food at temperatures of 25, 20 and 12–14°C. [77, 68 and 53·6–57·2°F.] and relative humidities of 38–40, 35–40, and 45 per cent., respectively; those of *C. granaria* survived for up to 9, 15 and 45 days, and those of *C. oryzae* for 5, 8 and 22 days. When the humidity was increased to 75–80, 80–100 and 70–80 per cent., respectively, at the same temperatures, these periods rose to 31, 50 and 150 and 20, 45 and 95 days for the two species. Thus, the weevils may well survive a whole summer in empty storehouses.

When 100 adults of *C. granaria* were placed in a barrel of wheat and kept at room temperature for 4 months, most eggs were found at depths of less than 10 ins., but a few occurred down to about 5 ft. Complete mortality of all stages of both species was given by exposure to temperatures of 55, 48–50 and 45°C. [131, 118–122 and 113°F.] for 30, 45 and 210 minutes, respectively. At 4·5°C. [40·1°F.], adults of *C. granaria* survived in grain for over 100 days, but the immature stages for only 70. In *C. oryzae* these periods were 80 and 35 days.

At −2°C. [30·2°F.], no eggs of the former survived after 20 days, but the adults lived for up to 40. Adults of both species were kept in bags or jars in wheat in unheated storerooms during the winters of 1936–37 and 1937–38. *C. granaria* did not survive more than 2 months in either case, or *C. oryzae* for more than 1 month. The weevils can therefore overwinter only in heated storerooms, or in large masses of grain in which a higher temperature is maintained. In southern Sweden, store-rooms are frequently over stables, cow-sheds or living rooms, which provide the necessary warmth.

The second half of the paper comprises a review, mostly from the literature, of the prevention and control of infestation by the weevils. Experiments showed that they did not penetrate into jute sacks lined with kraft paper, although those in them could eat their way out. All the weevils were killed in sacks containing about 250 lb. grain kept at 60–70°C. [140–158°F.] for 2½ days, the temperature in the middle of the sacks then being 46–47°C. [114·8–116·6°F.]. As heating to this temperature has undesirable effects on grain that is to be used for seed or baking, it is of restricted application as a method of control. Complete mortality of all stages was given by drying the grain in a vacuum apparatus for 2½ hours at 44°C. [111·2°F.] and in a hot air chamber for 1½ hours at 47°C., a higher temperature than that normally employed in drying grain. The simplest method of control, however, is to kill the weevils by cold. The average temperature of wheat, of which the moisture content was 14 per cent., stored in wooden silos in southern Sweden varied in 1936 from 2·5 to 14°C. [36·5–57·2°F.], so that the immature stages could not have survived the early months of the year. Observations in 1937 confirmed this conclusion.

In an experiment on fumigation with hydrocyanic acid gas, two air-tight rooms containing malt barley spread on the floor and in sacks of about 250 lb., in which jars or bags containing weevils of both species were placed, were fumigated for 2 and 8 days, respectively, with HCN obtained from Zyklon B used at a rate that gave a gas concentration of 1·2–1·3 vols. per cent. at a temperature of 25°C. Complete mortality was given of all weevils in the sacks after 2 days, but in the grain on the floor all stages of the weevils below a depth of 1 ft. were still living after 8 days. A further test was made by fumigating 40,000 sacks of rice infested with *C. oryzae*. The sacks were piled 30 high, and fumigated with HCN at the same rate as before for 10 days at 30°C. [86°F.]. When the rice was examined 2 weeks after fumigation, no live insects could be found, and after several months the rice was still uninfested. Complete mortality of all stages of *C. granaria* in grain was also given by fumigation with a proprietary preparation containing trichlorethylene and with a 3 : 1 mixture of ethylene dichloride and carbon tetrachloride at the rate of 1 fl. oz. to 2 cu. ft. of grain for 1 day at room temperature.

Experiments showed that Naaki (silicic acid) dust at the rate of 1 per cent. by weight was not effective against *C. granaria* at atmospheric humidities above 45–55 per cent. [*cf.* **24** 342; **25** 528]. At this humidity, mortality was complete in 3 weeks, whereas although at 70–75 per cent. humidity 100 per cent. mortality was given in about 2 months, some oviposition took place. Of a number of other proprietary preparations stated to kill *C. granaria* in grain and to prevent further infestation, only two dusts containing mercury were effective.

JOHANSSON (E.). **Studier rörande de på gräs och sädesslag levande tripsarnas biologi och skadegörelse. I. I vetefält och vallar förekommande associationsformer samt skadegörelsens natur och omfattning.** [Studies on the Biology of Thysanoptera that live on Grass and Cereals and the Injury caused by them. I. Types of Association that occur in Wheat Fields and in Grass, and the Nature and Extent of the Injury.]—*Medd. Växtskyddsanst.* no. 24, 65 pp., 8 figs., 25 refs. Stockholm, 1938. (With a Summary in German.)

In this paper, the author has collected together and compared with the literature observations made over a number of years on the life-history, local distribution and feeding-habits of Thysanoptera that attack cereals, chiefly wheat, and other grasses in southern and central Sweden. The species did not differ greatly in their life-histories.

Limothrips cerealium, Hal., was numerous and widespread on wheat in southern districts, but was rare where the winter temperature falls below —3°C. [26·6°F.]. The overwintered females are sexually mature on emergence from hibernation and oviposit in the young leaves of sprouting wheat. Adults of the first generation are present after the wheat has flowered, and the females oviposit in the ears. Adults of the second generation appear in about a month and leave the wheat fields in the first half of August, at harvest time. A partial third generation on other food-plants sometimes develops. If the first generation develops late owing to unfavourable weather conditions, the adults leave the ripe wheat for spring-sown wheat, oats or, occasionally, barley, and when these begin to dry up, they go into hibernation. This generally occurs in late August or early September. *L. denticornis*, Hal., which is less numerous, has a similar life-history.

Haplothrips aculeatus, F., and *H. distinguendus*, Uzel, were the commonest species found, and occurred throughout the season on many food-plants. They have two summer generations on wheat, of which the adults were most numerous at the end of June or early in July, and about a month later. The oviposition period is long, so that both early and late flowering varieties of wheat are attacked. *Haplothrips* spp. are resistant to cold and occur throughout Sweden. *Frankliniella intonsa*, Tryb., and *F. tenuicornis*, Uzel, have two generations before the wheat is ripe ; the adults are common from the beginning of June, and the population reaches its peak at the end of June. *Chirothrips hcmatus*, Tryb., and *C. manicatus*, Hal., occurred in wheat-fields throughout the area investigated, but in very small numbers. *Anaphothrips obscurus*, Müll., was occasionally very abundant, and was then of economic importance. It was not numerous from 1932 to 1937, and only one generation a year was observed. Overwintered females appeared in April or May and oviposited in the leaf-sheaths. Other species observed in wheat fields were *Aptinothrips rufus*, Gmel., which attacked grasses of all kinds, *Stenothrips graminum*, Uzel, which occurred mainly in southern coastal regions, and *Thrips* spp., which were of little importance.

The later sections of the paper comprise a detailed discussion of the local and relative frequencies of these species of Thysanoptera, and a review from the literature of the ways in which the cellular structure of various grasses protects them from attack, and the relation of Thysanoptera to white-ear [*cf. R.A.E.*, A **25** 306, 488].

CAMERON (A. E.). **Insect and other Pests of 1937.**—*Trans. Highl. agric. Soc. Scot.* 1938 repr. 35 pp., 41 figs., 19 refs. Edinburgh, 1938.

In 1937, an intense outbreak of *Charaeas graminis*, L., occurred in pastures in the central and southern uplands of Scotland. The bionomics and control of this Noctuid are discussed [*cf. R.A.E.*, A **5** 481], and a list is given of the grasses and other plants it attacks. The larvae occurred at elevations of at least 700 ft., but adults were observed at 250 ft. or less. Evidence accumulated by the author indicates that the eggs overwinter; and laboratory tests showed that they are readily killed by desiccation and moulds. The larvae are devoured in quantities by birds. When 150 larvae and pupae taken in the field were kept in a cage, a single individual of *Ichneumon gradarius*, Wesm., emerged from each of 21 pupae.

Trachea (*Apamea*) *secalis*, L., caused considerable damage locally to barley and oats, 10 per cent. of the crop being lost in one field of barley. Recent papers on its habits [**24** 795] are briefly reviewed. The moths oviposit in summer on weeds or grasses, and the evidence indicates that the larvae feed on them before attacking cereals in the next spring. Since infestation usually occurred in cereals following a hay crop or pasture, it is suggested that a rotation should be adopted in which cereals do not immediately follow grass. When 10 larvae of *T. secalis* taken on oats and barley in May–June were kept in a laboratory cage planted with barley, a parasitic larva emerged from each of 4 of them and spun a cocoon in the soil. Two of the cocoons yielded adults of *Lissonota cylindrator*, Vill., and *L. sulphurifera*, Grav., respectively. Neither of these Ichneumonids has previously been recorded from *T. secalis*.

Hydroecia micacea, Esp., which is polyphagous, was unusually abundant on potato. The eggs are laid in autumn on the lower leaves of the food-plants. The larvae pass the winter in the soil and tunnel in the stems in the spring and early summer. Wild food-plants should be eradicated and cultivated ones, when infested, should be collected and destroyed. Descriptions are given of various stages of six species of Lepidoptera, the larvae of which feed on heather, but cause little injury to it. Larvae of *Borkhausenia pseudospretella*, Staint., were found boring into corks of a valuable stock of bottled wines that were unsealed or imperfectly sealed with wax so that oviposition was possible on the exposed cork; the galleries, which were filled with frass, extended into the wine-soaked ends. Corks securely sealed with lead-foil were not damaged.

Larvae of *Dascillus cervinus*, L., the adult and larva of which are described, were found in large numbers in January in a dry pasture that was being ploughed for oats. The grass was very poor throughout the field. When the oats were sown in spring, however, they escaped damage, as the grubs had ceased feeding prior to pupation.

BUTOVITSCH (V.). **Om granbarkborrens massförökning i Södra Dalarna.** [The Outbreak of *Ips typographus*, L., in South Dalecarlia.]—*Norrlands SkogsvFörb. Tidskr.* no. 2, 1938 repr. 36 pp., 9 figs. Stockholm, 1938. (With a Summary in German.)

As a result partly of damage caused by the severe storms in 1932 [*cf. R.A.E.*, A **23** 222], but principally of the warm dry summers in the years 1933–37, the infestation by *Ips typographus*, L., of spruce

forests in central and southern Sweden increased very seriously. A detailed account is given of the outbreak as observed in a spruce forest in central Sweden. The first injury to living trees was noticed in 1934, when single trees or small groups of trees were attacked. Infestation spread in 1935, 1936 and 1937, in which years the numbers of trees felled owing to infestation were 3,750, 50,000 and 70,000, respectively. It was expected that the outbreak would collapse in 1938, as a result of increased larval mortality and the measures that were adopted.

In 1937, the mass appearance of the overwintered adults occurred on 4th May, 3–4 weeks earlier than usual, before the work of felling trap trees was completed, and consequently, standing trees were attacked up to September. Adults of the first generation were observed from mid-June, and those of a second were probably present from the beginning of August. The trap trees were readily attacked, but were insufficient in numbers, as the beetle population was unexpectedly increased by immigration from neighbouring forest areas in which no measures had been taken. Consequently, living trees in the immediate vicinity of trap trees were more heavily attacked than those farther from them.

Stands less than 40 years old, closed stands of all ages, mixed stands with a predominance of pine, and stands on boggy ground were little or not at all attacked. In general, trees exposed to the sun on the southern or western edges of stands were heavily infested, although when the trees on the sunny sides of clearings were young, older trees on the other sides were preferred; of trees of the same age, those with thicker trunks were more favoured for oviposition.

Observations in 1934 showed that felled trap trees of which the sides exposed to the sun were covered with brushwood were 20 per cent. more effective than uncovered trees, as the bark did not dry up. Some protection to standing trees with smooth bark was given in 1936 and 1937 by applications of Xylamon [**25** 658].

Spessivtseff (P.). **Beitrag zur Biologie von** *Hylurgops palliatus* **Gyll.** [A Contribution to the Biology of *Hylastes palliatus*.]—*Ent. Tidskr.* **59** no. 3–4 pp. 159–162, 1 pl., 1 fig. Stockholm, 1938.

Notes, based on observations made over a number of years near Stockholm, are given on the life-history of *Hylastes* (*Hylurgops*) *palliatus*, Gylh., which occurs in pines and spruce throughout Sweden, but does not attack healthy trees. The overwintered adults leave their hibernation-quarters when the temperature averages 5·5°C. [41·9°F.], at about the same time as those of *Myelophilus* (*Blastophagus*) *piniperda*, L., but whereas females of the latter form tunnels for oviposition in late April or early May at an average temperature of 6°C. [42·8°F.], those of *H. palliatus* feed in tunnels beneath the bark of felled pines or spruce from the beginning of May and emerge from them to make oviposition tunnels when the temperature averages 10°C. [50°F.]. Pairing sometimes takes place in the feeding galleries. Oviposition occurs in central and southern Sweden at the end of May or the beginning of June, the earliest observed date being 22nd May, in the warm seasons of 1925, 1927 and 1930; the eggs are deposited in groups in the galleries beneath the bark of pines and spruce felled during the previous winter season, sickly trees or exposed stumps, or

occasionally in roots. The larvae mine under the bark, but hardly touch the sapwood until they bore into it to form pupal chambers. Pupation occurs at a temperature of 16·5–17°C. [61·7–62·6°F.], generally between 15th and 20th July. The young adults begin to emerge about the end of July ; most of them overwinter beneath the bark, but a few seek winter quarters elsewhere, in the roots of stumps or in the ground litter.

H. palliatus is not a vector of blue rot, although it often develops in trees attacked by the fungus, and in so far as many predators and Hymenopterous parasites of other forest pests live in its galleries, it is a beneficial insect. A list of such parasites and predators is given.

Bleton (C. A.). **Observations sur la biologie d'*Hylemyia sepia* Meigen (Diptère Muscidae), parasite du blé au Maroc.**—*Bull. Soc. Sci. nat. Maroc* **18** pt. 1 pp. 3–5. Rabat, October 1938.

Serious injury was caused to autumn-sown wheat in Morocco in the growing season of 1936–37 by larvae of *Hylemyia sepia*, Mg. They had also been present in previous years, but in insignificant numbers. The immature stages are very briefly described. It was observed that adults emerge from aestivating pupae in November and December, after the abundant autumn rains. The first pupae of the new generation were found at the end of January in decomposed stems or near the surface of the soil beneath the infested plants, and adults emerged after 30–35 days and oviposited on the wheat stems. The eggs hatched in 4–6 days, and the larvae developed inside the main stem, never more than one in each, and pupated in the soil at the end of April. These pupae, and also some of those of the preceding generation, do not give rise to adults until the autumn. The mining of the larvae inside the main stem causes the terminal bud to become etiolated and yellow and, if the autumn is wet, the whole plant rots rapidly and disappears. Sometimes, the leaves below the attacked portion remain green and tiller. Attack is not usually localised and was so severe in December that some fields had to be ploughed and re-sown.

Jack (R. W.). **Annual Report of the Division of Entomology for the Year ended 31st December 1937. Agriculture.**—*Rhod. agric. J.* **35** no. 8 pp. 652–659 ; also in *Bull. Minist. Agric.* [*S. Rhod.*] no. 1080 pp. 1–8. Salisbury, August 1938.

In 1937, swarms of *Nomadacris septemfasciata*, Serv., were present throughout the year in Southern Rhodesia, but its numbers were relatively small. Severe injury to maize by *Laphygma exempta*, Wlk., *Tanymecus destructor*, Mshl., and *Systates exaptus*, Mshl., was reported from several localities, and local damage was caused by *Exora discoidalis*, Jac., and *Marasmia trapezalis*, Gn. *S. exaptus* also occurred on *Dolichos lablab*, and, in the same district, the larvae attacked the roots and germinating seed of maize planted in land that had been green-manured with *Crotalaria juncea*.

On tobacco, the incidence of *Bemisia rhodesiaensis*, Corb., the vector of leaf-curl, decreased owing to the compulsory removal of the plants from the fields after the harvest in the late dry season ; fair control of the cricket, *Brachytrypes membranaceus*, Dru., which attacks newly transplanted tobacco, was obtained by a moist bait of barium fluosilicate and maize meal (1 : 40) applied in the fields immediately before

planting out ; and a poison bait with these ingredients gave promising results against the cutworm, *Agrotis* (*Euxoa*) *segetum*, Schiff. Tobacco was also attacked by *Dasus* (*Gonocephalum*) *simplex*, F., *Analeurops cuthbertsoni*, Mshl., *Phthorimaea operculella*, Zell., *P. heliopa*, Lw., *Myzus persicae*, Sulz., and grasshoppers. The situation regarding infestation of stored tobacco by *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., remains satisfactory [*cf. R.A.E.*, A **24** 520]. Supplementary control measures practised include smearing all store-room windows with engine-oil. The oil is sticky and catches the adults of both species, which tend to fly to the windows, particularly in the late afternoon.

Other pests included the Galerucids, *Exora discoidalis*, Jac., and *E. apicipennis*, Jac., attacking *Crotalaria juncea* ; *Ootheca mutabilis*, Sahlb., on cowpeas and soy beans ; *Eriosoma lanigerum*, Hsm., on apple ; *Parasa latistriga*, Wlk., on plum ; *Bagrada hilaris*, Burm., *Plutella maculipennis*, Curt., and *Brevicoryne brassicae*, L., on crucifers ; *Epimadiza hirta*, Mall., on gladiolus ; *Brithys pancratii*, Cyr., on amaryllidaceous plants ; and *Termes badius*, Hav., *T. pauperans*, Silv., and *T. transvaalensis*, Sjöst., infesting wooden structures in buildings.

Hopkins (J. C. F.) & Mossop (M. C.). **The Spraying of Tobacco Seed Beds and Control of Rosette Disease.**—*Rhod. agric. J.* **35** no. 10 pp. 760–764, 1 pl., 1 ref. Salisbury [S. Rhodesia], October 1938 ; also *Bull. Minist. Agric.* [*S. Rhod.*] no. 1086, 5 pp., 1 pl., 1 ref.

It has been definitely established that *Myzus persicae*, Sulz., is the vector of tobacco rosette, a virus disease of tobacco recently recognised in Southern Rhodesia [*R.A.E.*, A **26** 377]. In 1937–38, the disease spread to most of the areas in the colony in which tobacco is grown. Its absence from some crops on which the Aphids were numerous suggests that it may have originated in some central focus and spread rapidly outwards, rather than that sources of infestation occur naturally in the colony ; in this case, further spread might be arrested. There is reason to believe, however, that at least five other plants on which the Aphid feeds may serve as reservoirs of the virus. These comprise potato, tomato, *Zinnia* and two common weeds, *Solanum nigrum* and the false Cape gooseberry (*Nicandra physaloides*).

The following control measures are recommended : the destruction of residual plants after reaping, and of tobacco re-growth in fallow lands ; the eradication of infected seedlings from seed-beds and of weeds from seed-bed sites ; the cessation of cultivation of tomatos, potatoes and *Zinnia* near tobacco lands and seed-beds ; and the addition of nicotine sulphate (1 : 500) to the sprays of Bordeaux mixture normally applied to the seedlings every 5 days. These sprays should also include 0·3 per cent. lead arsenate, and a spreader and should be applied at high pressure to reach the lower surfaces of the leaves. The nicotine sulphate will control both *M. persicae* and *Bemisia rhodesiaensis*, Corb., the vector of leaf-curl, and the lead arsenate will reduce the attack of various leaf-eating insects.

Smee (C.). **Report of the Entomologist.**—*Rep. Dep. Agric. Nyasaland* 1937 pp. 19–26. Zomba, 1938.

In 1937, injury to cotton in Nyasaland by *Dysdercus* spp. was less severe than in 1936, but heavy infestation by *Diparopsis castanea*,

Hmps., was general and was a more important factor in the reduction of crops in the Lower River districts in 1936 and 1937 than the time of planting or weather conditions, alone or together [*cf. R.A.E.*, A **26** 113]. *Platyedra gossypiella*, Saund., was present on cotton in the north of the Protectorate, and *Syagrus morio*, Har., caused some damage to roots of cotton plants in the south.

Cereals were again injured by *Laphygma exempta*, Wlk. ; its parasite, which was recorded as a Microgasterid [**26** 114], was found to be a Eulophid of the genus *Euplectrus*, near *platyhypenae*, How. The infestation of tung-nut trees (*Aleurites*) by *Aspidiotus hederae*, Vall., was brought under control in the first half of 1937 by the Eulophid, *Aspidiotiphagus lounsburyi*, Berl. & Paoli. Rosette disease of ground-nuts [*Arachis*] was less severe and widespread than in 1936, as the vector, *Aphis laburni*, Kalt. (*leguminosae*, Theo.) was not so abundant. Other pests included : *Apion* (*Piezotrachelus*) *ugandum*, Wagn., on bambarra ground-nuts [*Voandzeia subterranea*] ; *Anthores leuconotus*, Pasc., on coffee ; and *Gonipterus scutellatus*, Gylh., on *Eucalyptus* [**26** 203].

In January, an unusually pale-coloured form of *Helopeltis bergrothi*, Reut., was observed feeding on shoots of *Eucalyptus*, adjacent to uninfested tea bushes, and causing the formation of cankers ; all stages of the bug were present. The infestation was severe, but of short duration. Normal-coloured examples of this Capsid have been found attacking sucker growth of *Eucalyptus*, causing it to wilt. The pale-coloured form fed on tea in captivity, and the view that it is not a distinct species was confirmed from an examination of the genitalia by W. E. China, so that it seems advisable to avoid the placing of tea nurseries near young trees or sucker growth of *Eucalyptus*.

Locusts caused little injury to crops in 1937 ; *Nomadacris septemfasciata*, Serv., was again the only species present. Oviposition, which had started in December 1936 [**26** 114], continued through January 1937, hatching occurred from January to March, and the first flying swarms appeared on 10th March. For the second year, there was no development in the three most northern districts. During November the breeding coloration appeared in several swarms, mainly in the south, and there was some indication of a southerly movement in some areas. Only about half a dozen swarms were reported throughout the Protectorate in December ; no explanation of this was evident, but it appeared that practically no eggs were laid in November or December. Some food crops were destroyed in January by adults of the previous year's generation, and wheat was attacked in August in one district by those of the new generation. Hoppers caused some injury to cotton and food crops.

Fourth Annual Report of the Coffee Research and Experimental Station, Lyamungu, Moshi, 1937.—*Pamphl. Dep. Agric. Tanganyika* no. 22, 55 pp., 4 graphs. Dar es Salaam, 1938. Price 1s. 50.

In the report of the Agricultural Officer, F. R. Sanders states (p. 41) that injury to coffee in Tanganyika in 1937 by leaf miner [*Leucoptera*] gave rise to severe leaf fall. Spraying with nicotine sulphate failed to give control when applied in January or February, but it was effective when applied against pupae on the lower surface of the leaf.

Considerable injury was caused by *Antestia lineaticollis*, Stål, in June–July.

In the Entomologist's report (pp. 51–52), F. B. Notley reviews work on insect pests during the first 8 months of 1937. It was found that while severe leaf-miner infestations of coffee under shade consisted almost exclusively of *Leucoptera daricella*, Meyr., severe infestations in unshaded coffee occasionally consisted almost entirely of *L. coffeella*, Guér. [*cf. R.A.E.*, A **23** 664]. Five more parasites of *Leucoptera* were recorded [*cf.* **25** 76], but have not yet been specifically identified; of these, a Braconid near *Hormius* and an Encyrtid (? *Ageniaspis* sp.) were important. A severe outbreak of thrips [*Diarthrothrips coffeae*, Will.] occurred at the beginning of the year. It can be controlled by shade and the avoidance of windbreaks, but where the use of shade is impracticable, early forecasts of outbreaks enable adequate measures to be taken [**24** 285]. Insecticide tests indicated that a spray of Derrisol in water or Bordeaux mixture (1 : 500) is effective; it is cheaper than nicotine sulphate. The numbers of thrips in the field were closely correlated with the maximum day temperature occurring 10 days previously. Flower buds of coffee were attacked by a Capsid, probably *Lygus coffeae*, China, in the Kilimandjaro area. In experiments, baits consisting of maize flour and Paris green (1 : 50) gave 90·9–98·5 per cent. mortality of *Dasus* (*Gonocephalum*) *simplex*, F. Investigations on ground treatments showed that this beetle was almost completely absent under banana mulch. In the laboratory, it was unable to damage sound coffee seedlings, but it could enlarge mechanical injuries or those produced by cutworms, causing the plants to die.

Ballard (E.). **Report of the Chief Plant Protection Officer for the Year ended 31st March 1938.**—*Rep. Dep. Agric. Palestine* 1937–38 pp. 71–73. Jerusalem, 1938.

Syringopais temperatella, Led., appeared earlier than usual on wheat and barley in Palestine in the year under review owing to early rain in December 1937 followed by nearly three weeks of drought. Subsequently, excessive rain and cold checked the growth of wheat and intensified the injury to the leaves; in March, however, the crops began to recover rapidly. *Aphelinus mali*, Hald., was imported from Egypt for the control of *Eriosoma lanigerum*, Hsm., on apple in 1937; although the first colonies liberated were weak, all but one made rapid progress.

Cherian (M. C.). **Mite (*Acarina*) Pests of Crops in South India and Methods for their Control.**—*Agric. Live-Stk India* **8** pt. 5 pp. 537–540, 2 pls, 10 refs. Delhi, September 1938.

This paper comprises notes on nine species of mites that attack crops in southern India, showing their food-plants, the kind of injury they cause and, in some cases, the treatments applied for their control.

Tetranychus telarius, L., is found on various plants, the most important of which are hemp (*Cannabis sativa*), castor (*Ricinus communis*), tomato, and cambodia cotton (*Gossypium hirsutum*). It attacks leaves and flowers of hemp, and severe infestation greatly reduces the quality of the crop. Applications of sulphur are generally effective against all mites, but cannot be used on hemp, as traces of

sulphur remain in the prepared cakes and produce irritation when they are smoked. Control has been obtained, however, with a spray of 1 lb. fish-oil resin soap in 6 gals. water, which did not affect the quality of the cakes. *Paratetranychus indicus*, Hirst, causes the leaves of *Sorghum* to turn bright red, and it also attacks sugar-cane [*cf. R.A.E.*, A **23** 589]. All stages are found on the lower surfaces of the leaves, and the life-cycle lasts 9–12 days. Damage to the crop is greatest when young plants are attacked.

The other mites, which are dealt with very briefly, are *Tetranychus fici*, Hirst, which attacks the leaves and fruits of figs ; another species of the same genus, apparently undescribed, which has caused considerable damage to *Hibiscus esculentus* ; *Schizotetranychus* (*T.*) *hindustanicus*, Hirst, which produces small white patches on the leaves of *Citrus*, and has been found in fairly large numbers on *Melia azadirachta* ; *Paratetranychus punicae*, Hirst, which attacks pomegranates and grape-vines, particularly when the leaves are young ; *P.* (*T.*) *bioculatus*, W.-M., and *Eriophyes carinatus*, Green, which are sometimes serious pests of tea ; and another species of *Eriophyes*, which occurs on country cottons (*Gossypium herbaceum* and *G. indicum*), usually late in the season.

Sen (H. K.). **Entomological Section.**—*Rep. Indian Lac Res. Inst. Namkum* 1937–38 pp. 16-26. Calcutta, 1938.

Of the insects attacking host trees of *Laccifer lacca*, Kerr, at Namkum (Bihar) during the year under review, *Aonidiella* (*Aspidiotus*) *orientalis*, Newst., was again a major pest [*cf. R.A.E.*, A **25** 635]. Of insecticides used as sprays or paints against it, a completely refined low-boiling petroleum distillate, closely allied to kerosene, gave percentage mortalities of 91 and 100 after 10 and 21 days, respectively, and did not injure the trees. Lime-sulphur was much less effective, and waste motor oil damaged the trees severely. Petrol appeared to be the most effective of the fumigants tested against termites. *Tessaratoma javanica*, Thnb., was abundant in June–August 1937.

The 17th generation of the parthenogenetic strain of *L. lacca* was developing satisfactorily at the end of the year, but the attempts to produce standard strains by cultivation in vitro were unsuccessful.

The percentage parasitism of *L. lacca* for the year averaged 7·5 ; there was again little hyperparasitism. In further tests with the two principal predators [*cf. loc. cit.*], adults of *Eublemma amabilis*, Moore, lived for 8–9 days when starved, 11–12 when supplied with water, and 9–10 when given 2 or 5 per cent. solutions of cane sugar or glucose, and the females laid averages of 139, 133, and 103–114 eggs, respectively. Adults of *Holcocera pulverea*, Meyr., lived 5–6, 11–12, and 14–18 days under the same conditions, and the females laid averages of 4 eggs when starved, 12 when given water, and 30, 20 and 36, respectively, when supplied with cane sugar (2 or 5 per cent.), and 2 and 5 per cent. glucose.

Parasitism of the larvae of *E. amabilis* by *Microbracon greeni*, Ashm., fell to an average of 12·8 per cent., as no laboratory-bred parasites were liberated. The adult parasites lived for an average of only 3–5 days and did not oviposit when given water or when starved ; the females lived longer and oviposited when given 2 or 5 per cent. solutions of cane-sugar or glucose, maximum longevity and percentage ovipositing (14 days and 50) being obtained with 2 per cent. cane-sugar

solution. *M. greeni* also oviposited on larvae of *Cosmolyce* (*Lampides*) *boetica*, L., but no adults were bred; some adults were reared from larvae of the ant, *Cataglyphis bicolor*, F., and *Plutella maculipennis*, Curt., but *Etiella zinckenella*, Treit., which is common on peas in the district, was a more satisfactory host. The best was *Platyedra gossypiella*, Saund., but it is not available locally.

In the laboratory, *Microbracon hebetor*, Say, parasitised 65 per cent. of the larvae of *Eublemma amabilis* and *H. pulverea*, and 90 per cent. of those of *Etiella zinckenella*, which promises to be a useful alternative host. It also parasitised an Ichneumonid parasite of *E. zinckenella*. During the year, several small releases of *M. hebetor* were made, and in one case, in which adults were liberated in December, one parasitised larva of *H. pulverea* was found in April. *Apanteles tachardiae*, Cam., and *Pristomerus testaceicollis*, Cam., were of little use in the control of *H. pulverea*, and as they could not be reared satisfactorily in the laboratory [*cf.* **25** 636], work on them is to be discontinued.

An undetermined species of Trichogrammatid was observed in the field parasitising eggs of *E. amabilis*, *H. pulverea*, the Lycaenid, *Tarucus theophrastus*, F., and a Lepidopterous pest of *Zizyphus jujuba*. In the laboratory it also parasitised eggs of *Ephestia* sp. A second Trichogrammatid was also reared from eggs of *T. theophrastus* and from those of two Geometrids of the genus *Thalassodes*, and parasitised eggs of *E. amabilis* and *H. pulverea* in the laboratory. These two parasites are of great potential importance, although they attack the eggs of the predators only in the early stages of the lac crop, before the encrustation has coalesced. A third Trichogrammatid reared from eggs of the two species of *Thalassodes* did not parasitise either *E. amabilis* or *H. pulverea* in the laboratory.

Ayyar (T. V. Ramakrishna). **Two Caterpillars of economic Importance not recorded before from S. India.**—*J. Bombay nat. Hist. Soc.* **40** no. 2 pp. 336–338. Bombay, September 1938.

The leaves of *Coleus parviflora* cultivated as a vegetable in Malabar are damaged by the larvae of *Pycnarmon cribrata*, F., and *Phostria piasusalis*, Wlk., which have not previously been recorded as pests in India. The adults and larvae of these Pyralids are very briefly described. The eggs of *Pycnarmon* are laid on the young leaves, and the larva feeds and later pupates inside a longitudinally folded leaf. The pupal stage lasts 10–12 days. The larvae are heavily parasitised by *Microgaster psarae*, Wlkn. The larva of *Phostria piasusalis* webs together the end leaves of a shoot and feeds in the shelter thus formed.

Djou (Y. W.). **A Lima Bean Leaf-feeder,** *Diacrisia obliqua* **Wkr. (Lepidoptera : Arctiidae).**—*Lingnan Sci. J.* **17** no. 4 pp. 639–645, 4 figs. Canton, October 1938.

A batch of newly-hatched larvae of *Diacrisia obliqua*, Wlk., collected on 4th November 1930 from lima beans in China made cocoons early in December. Adults emerged early in January 1931; the males lived 12–24 days, and the females lived 14–27 days and laid 342–1,356 eggs. The incubation period was 10–17 days, and the percentage hatch 82·96–91. The resultant larvae made their cocoons late in March. The adults emerged in mid-April, lived only 7–9 days and laid fewer eggs than those of the preceding generation. The incubation

period was 6–11 days, and the percentage hatch 52–73. The larvae developed in 29–38 days. All stages are described. Eggs are usually deposited in masses on the lower surface of the leaves. When temperature and humidity were high, the embryos were very easily killed by the moulds that grew on the plant, as the shells are very thin. The newly-hatched larvae often ate eggs, both fertile and infertile, and the older ones often ate other larvae in preference to the leaves of the food-plant. The full-grown larvae usually entered the soil and made thin cocoons near the surface or at a depth not exceeding 2½ ins., but occasionally only fastened some leaves together with a little silk and pupated in these without making cocoons. The prepupal period lasted 5–6 days. The adults were inactive during the day; pairing usually took place in the early morning or late afternoon. Oviposition began 1–3 days after emergence. In the laboratory, the larvae fed on the foliage of a large variety of plants belonging to several families and preferred mulberry to the original food-plant. The larvae were sometimes attacked by a small Hymenopterous parasite, several larvae of which developed in one host. They left it when it was in the fourth or fifth instar and made cocoons among the hairs.

Gurney (W. B.). **Grasshopper Swarms. Review of Methods of Control.** —*Agric. Gaz. N.S.W.* **49** pt. 8 pp. 431–434. Sydney, August 1938.

Though *Austroicetes cruciata*, Sauss., and *Phaulacridium vittatum*, Sjöst., occasionally appear in the Riverina district and the Dividing Ranges, respectively, *Chortoicetes terminifera*, Wlk., is the most injurious locust in New South Wales. Its life-history is briefly outlined [*cf. R.A.E.*, A **22** 378], and the outbreaks of it in the State are recorded. Those that occurred in 1934–35 and 1937–38 were very extensive, and control during 1934–35 cost £12,500. The organisation of control and the legislation by which it can be enforced are described. The principal method of destruction is the use of baits, prepared with bran, sodium arsenite, molasses and water, which saved several million pounds worth of grass and crops during 1937–38.

Powell (H. R.). **The Control of Mussel Scale** (*Lepidosaphes ulmi* **L.**).— *J. Dep. Agric. W. Aust.* (2) **15** no. 3 pp. 285–287, 5 figs. Perth, W.A., September 1938.

Despite the winter use of red spraying oils, *Lepidosaphes ulmi*, L., is spreading on apple in the southern part of Western Australia, and if left unchecked has a serious devitalising effect on the trees. It appears to have only one generation a year, and observations in one orchard from October to December 1937 showed that the maximum emergence of newly hatched crawlers did not occur until 10th December. Complete control was obtained on trees sprayed with lime-sulphur (1 : 12) during the third week in September and on those sprayed with white oil (1 : 60) during mid-December. The lime-sulphur should not be used at the strength stated if the spurs are bursting, and cool days should be chosen for the application of the white oil.

Notice to Fruit Growers.—*J. Dep. Agric. W. Aust.* (2) **15** no. 3 p. 341. Perth [W.A.], September 1938.

Regulations for the control of fruit-flies in Western Australia, gazetted on the 20th May 1938 under the Plant Diseases Act, 1914–

1938, state that all infested fruit must be picked from the trees and the ground daily, and destroyed by boiling or by steeping for three days in a vessel of water and kerosene, and that a sodium fluosilicate bait must be applied once every six days for six weeks before the fruit is ripe and two weeks after it is picked. The bait must consist of a specified proprietary mixture, or of 1 oz. sodium fluosilicate, 2½ lb. sugar and 4 gals. water. The addition of any fruit juice will increase its attractiveness. It is applied to the foliage at the rate of 1 gal. for 40 fruit-trees or 100 grape-vines, with a spray pump or syringe, or by splashing on with a brush or perforated tin.

Norris (K. R.). **A Population Study of the Red-legged Earth Mite (*Halotydeus destructor*) in Western Australia, with Notes on associated Mites and Collembola.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 84, 23 pp., 10 figs., 11 refs. Melbourne, 1938.

A full account is given of investigations carried out in a clover pasture in Western Australia mainly in 1935 and 1936 on the fluctuations in population density of *Halotydeus destructor*, Tucker, and the factors influencing them. Three generations occurred annually, and there was some overlapping. The numbers were greatest in spring, when the rate of survival was highest; this was chiefly due to the greater amount of vegetation, and therefore shelter, available. It is suggested that some essential food may be abundant in the flower heads of *Cryptostemma calendulaceum*, to which the mites are strongly attracted, and absent or scarce in other plants in the experimental pasture. Competition for food and particularly for shelter are probably important factors, that come into operation when the population increases above a certain level. There was evidence that high temperatures in spring prevented oviposition, and it appears that almost all the eggs that survive the summer do so within the bodies of the dead females. Mites frozen to immobility on a frosty morning did not seem to be injured. The mite prefers sandy soils, but quite large populations may be supported on heavy soils if there is adequate shelter.

The abundance of *Smynthurus viridis*, L., varied greatly in different situations, and in the same situation in successive years. In 1936, it appeared that the predacious mite, *Biscirus lapidarius*, Kramer, which was liberated in the pasture in 1932 and 1933, was at least partly responsible for the rapid decline of the numbers of this springtail at the end of the season.

Jacques (C.). **La mouche des fruits de la Nouvelle-Calédonie.**—*Rev. agric. Nouv. Calédonie* 1938 pp. 3133–3138, 6 figs. Nouméa, August 1938.

The injurious fruit-fly in New Caledonia is *Dacus psidii*, Frogg., the adult of which is briefly described. All kinds of fruits are attacked, but successful infestation of some, such as immature bananas and mangos, is prevented by abundant exudation of sap. Wild guavas are an important reservoir of infestation. The egg and larval stages last 3 and 6–7 days, respectively, in the hot season. The pupal stage is passed in the soil. From 2 green peaches each oviposited in once, 28 flies emerged. The measures suggested for control are the destruction of all fallen or infested fruits and the use, in small pots hung on the trees, of a bait of 1 part vanilla essence and 1 part ammonia

in 10 parts water. Fruits with a downy skin, such as peaches, may be protected by a spray of 1 lb. lead arsenate in 10 gals. water applied as soon as they form.

DA COSTA LIMA (A.) **Um novo gorgulho, broca da couve (Coleoptera : Curculionoidea).** [A new Weevil with Larvae boring in Cabbage.] —*Mem. Inst. Osw. Cruz* **33** fasc. 1 pp. 49–52, 2 pls. Rio de Janeiro, 1938.

A description is given of the adults of both sexes of *Tyloderma brassicae*, sp. n., the larvae of which bore in the stems of cabbage in Rio de Janeiro.

BERRY (P. A.). *Tetrastichus brevistigma* **Gahan, a pupal Parasite of the Elm Leaf Beetle.**—*Circ. U.S. Dep. Agric.* no. 485, 11 pp., 3 figs., 6 refs. Washington, D.C., July 1938.

In 1932 and 1933, *Tetrastichus brevistigma*, Gah. [*cf. R.A.E.*, A **24** 499] was found to be parasitising, in many cases heavily, pupae of the elm leaf beetle, *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.), in all sections of the north-eastern part of the United States from which adequate samples were obtained. Its life-history and effectiveness were therefore studied further in 1934 and 1935. It appears to be native to the United States and to be the only Hymenopterous parasite of the pupal stage of this beetle. It was not found in California in 1933, but was introduced in 1934, and had passed through one generation in the field by September.

The immature stages are described. The eggs are laid freely in the prepupae and pupae of the host, 1–8 at each insertion of the ovipositor, and hatch 2–5 days later at temperatures of 70–75°F. Except in overwintering individuals, the larval stage lasts 9–15 days at 75–85°F. The pupal stage lasts 9–13 days under favourable conditions, and up to 25 days at low temperatures. Adults lived up to 5 weeks at 68–70°F., but more than half died in the first week at 85–90°F., and all within 3 weeks. In the summer, the complete life-cycle may last 19–34 days. Usually, the adult parasites emerge from the pupa of the host, but occasionally 1–4 emerged from a dead adult. Such parasitised beetles live for only a few days.

Mating may take place immediately after emergence or not for a few days; and oviposition may begin in a few minutes, whether mating has occurred or not. The same host may be attacked more than once, and as many as 100 eggs and first-instar larvae have been found in one pupa. The average number of mature larvae found in a single host was 12, the maximum 37. No males were seen in 1932 or 1933, and very few in 1934. All females used for rearing in the laboratory were unmated, and only females were produced by them.

In the laboratory two generations and a partial third were produced during the summer. The adults of the overwintering generation began to emerge on 12th June, and those of the others on 20th July, 9th August and 10th September. There were still host pupae in the field for a short time after the emergence of the second generation. Almost all the third generation overwintered as larvae; those that did not emerged too late to find pupae in the field in areas where there is only one generation of the host in a season. In the field there were 3 overlapping partial generations. Almost all of the last, and some of

each of the other generations, passed the winter as full-grown larvae in the pupae of the host, emerging as adults early enough to attack the first pupating larvae, from the middle of June until the middle of July. About half of the total number of larvae overwintered in this way, and less than 10 per cent. of these died during the winter.

Parasitism was not so heavy early in the season as later, when 50–80 per cent. was common, and was heavier in the more exposed pupae on tree trunks than in those on the ground, which in heavily infested areas were in masses 2–3 inches deep. It is probable that the parasite cannot control severe outbreaks of its host when other conditions are favourable, but will be effective in conjunction with adverse conditions, and delay further outbreaks. It may be more effective further south, where there are two complete generations of the host in the season.

Muesebeck (C. F. W.). **Three new reared Species of *Apanteles* from California (Hymenoptera : Braconidae).**—*Proc. ent. Soc. Wash.* **40** no. 7 pp. 201–204. Washington, D.C., 27th October 1938.

Descriptions are given of both sexes of *Apanteles insignis*, *A. langei* and *A. dignus*, spp. n., reared in California from *Platyptilia acanthodactyla*, Hb., *Pyrausta insequalis*, Gn. (*subsequalis*, Gn.), and *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, respectively. *A. dignus* was also reared from *P.* (*G.*) *gudmannella*, Wlsm., in St. Croix (Virgin Islands).

McCrory (S. A.) & Vinson (C. G.). **Substitute Spray Materials.**—*Res. Bull. Mo. agric. Exp. Sta.* no. 292, 11 pp., 5 refs. Columbia, Mo., July 1938.

The abilities of various siliceous earths to reduce the volatilisation of nicotine from nicotine sulphate were compared in Missouri by mixing equal amounts with nicotine sulphate and water (1 : 800). The percentages of nicotine sulphate adsorbed by Lloyd's reagent [*cf. R.A.E.*, A **25** 21] and bentonite were 78·64 and 68·42, respectively, and 26 or less for four other siliceous earths. Bentonite is cheaper than Lloyd's reagent, and in 1937 it was used in sprays against the codling moth [*Cydia pomonella*, L.] on apple at the rate of just over 5 lb. to 1 U.S. pint nicotine sulphate and 100 U.S. gals. water, at which concentration the maximum adsorption was obtained. Bentonite is difficult to mix with water, and at first the sprays were prepared by mixing the nicotine sulphate, and the spreaders and adhesives, with enough water to wet the bentonite and form a thin paste, on the day before application. This paste was washed into the spray tank immediately before spraying. A conspicuous residue on fruit and foliage resulted from its use. Eventually it was found that the nicotine sulphate could readily be mixed with the bentonite in the dry condition. This mixture dispersed satisfactorily when added to the spray tank, a stable suspension was produced, and there was practically no residue on the fruit or foliage after spraying. Four cover sprays were applied in the experiments. Infestation by *C. pomonella* was not severe, but it appeared that the nicotine-bentonite, especially when used with adhesives and spreaders, gave good control whether lead arsenate was used in the calyx spray or not, and it was more effective than a calyx and four cover sprays of lead arsenate alone.

Sprays of magnesium sulphate gave inconclusive results against the corn ear worm [*Heliothis armigera*, Hb.] on maize, and were ineffective

against *C. pomonella* on apple and the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] on potato. Spraying with emulsions of paradichlorobenzene or beta-naphthol failed to kill larvae of *C. pomonella* in their cocoons and caused severe injury to growing plant tissue.

Richardson (C. H.) & Seiferle (E. J.). **Toxic and repellent Properties of some inorganic and organic Compounds and Mixtures in Grasshopper Baits.**—*J. agric. Res.* **57** no. 6 pp. 423–432, 11 refs. Washington, D.C., 15th September 1938.

The following is taken from the authors' summary of the results of investigations in Iowa to find a substitute for sodium arsenite as a grasshopper poison [*cf. R.A.E.*, A **21** 341]: 110 inorganic and organic substances were fed in bran-water baits to adults of *Melanoplus mexicanus mexicanus*, Sauss., the chemical substances constituting 1 per cent. by weight of the moist bait. The mean figures for net mortality within 72 hours, survival time in hours, bait consumption in grams, feeding time in minutes, and quantity of chemical substance consumed with the bait in milligrams per gram of body weight of the insect are recorded in a table [in which the mortality figures, at least for the more toxic chemicals, are one line out of adjustment]. The theoretical combinations of mortality and levels of bait consumption and feeding time with respect to a non-toxic food substance are also tabulated, and the results for each bait are grouped and discussed under the appropriate combination.

The highly toxic compounds, which gave 93–100 per cent. mortality, were zinc phosphide, ammonium fluoride, ammonium bifluoride, potassium fluoride, arsenic trioxide, sodium arsenite and zinc arsenite. Arsanilic acid and thallous sulphate were moderately toxic, giving 77 per cent. mortality, and crystal violet, diphenyl and mercurous chloride were slightly toxic, giving only 15–20 per cent. The three fluorides killed in the shortest time, zinc phosphide was intermediate with 22 hours, while the remaining lethal compounds killed in 31 to 47 hours. Highest bait consumption in the lethal group was given by zinc phosphide and lowest by zinc arsenite and sodium arsenite; the latter was outstanding in the small quantity of poison relative to body weight required for high toxicity.

Among non-toxic substances, consumption was greatest of baits containing magnesium carbonate, sodium benzoate, zinc cyanamide, barium fluoride and chromic oxide, and smallest of baits containing a rather large group of compounds, among which were most of the copper compounds and many of the phenols used. The cadmium and magnesium compounds were ineffective. The insoluble fluorides of barium, calcium and magnesium were non-toxic, and mercury bichloride was so repellent that the bait containing it was hardly eaten.

Sodium arsenite and diphenyl were probably more toxic to males than females. If undisturbed, *M. m. mexicanus* consumed about 10 per cent. of its body weight of non-toxic bran-water bait at one feeding.

Lowman (M. S.) & Sullivan (W. N.). **Pyrethrum Evaluation. Relation of Pyrethrin Content of Pyrethrum Flowers to their Toxicity to Mosquito Larvae.**—*Soap* **14** no. 11 pp. 89–91, 93, 119, 6 refs. New York, N.Y., November 1938.

In connection with investigations on the possibility of growing pyrethrum commercially in the United States, the quality of a large

number of flower samples had to be determined, and as chemical analysis for pyrethrin content requires considerable time, the more rapid method of finding their toxicity to mosquito larvae was adopted. This paper gives an account of experiments carried out to ascertain the degree of correlation existing between the toxicity of certain alcoholic extracts of pyrethrum to mosquito larvae and their pyrethrin content as determined by the Seil method. The composition of the flower samples is discussed, and the method of preparing the extracts is described in detail. The extract of each 15 gm. sample was made up to 60 cc. with 95 per cent. ethyl alcohol; 10 cc. was used for the biological tests and the remaining 50 cc. for the pyrethrin determinations. Duplicate tests were usually made each day on 19 extracts and a standard, which consisted of an alcoholic extract containing approximately equal amounts of pyrethrins I and II (5 mg. total pyrethrins per cc. ethyl alcohol). The extracts were diluted by dissolving 0·1 cc. extract in 9·9 cc. ethyl alcohol and adding 0·1 cc. of this solution to 100 cc. distilled water in a flask to which 50 or 100 fourth-instar larvae were subsequently transferred. Larvae that were eventually killed by the solution usually sank to the bottom and remained there, whereas those that withstood the initial action of the pyrethrins seldom died during the test period; the percentage "down" at the end of 4 hours was that used as the index of toxicity. Larvae of *Culex pipiens*, L., were used during the summer months, and those of *C. fatigans*, Wied. (*quinquefasciatus*, auct.) during the winter; preliminary tests had shown that these two species reacted similarly to pyrethrum extracts. A "toxicity number" was obtained by dividing the percentage mortality caused by the sample by that caused by the standard; by this means, the results, which sometimes varied from day to day owing to variations in the resistance of the larvae, were placed on a more comparable basis. To determine the accuracy of the single test in duplicate, 46 of the 112 extracts previously used were tested again on 5 different days, and the order of toxicity of the samples according to the average percentages of larvae killed was compared with that indicated by their toxicity numbers. The results obtained are discussed at some length.

The results of a statistical analysis of the data from the 112 samples seem to show a somewhat close correlation between toxicity to mosquito larvae and the contents of total pyrethrins or of pyrethrin I, though it is not sufficiently close to enable very accurate predictions of one variable to be made from the other; very little correlation appears to exist between toxicity and the content of pyrethrin II.

The toxicity number obtained from a duplicate test is a somewhat less reliable indication of pyrethrin content than the average percentage of larvae killed in tests on 5 different days. However, the duplicate test indicates whether the pyrethrin content of a sample is high or low and has been found of value for this purpose when dealing with the large numbers of samples that must be tested in developing strains of pyrethrum with a high pyrethrin content.

Schechter (M. S.) & Haller (H. L.). **Preparation of Pyrethrins. Isolation of Pyrethrin II—Effect of Aqueous Extraction on Pyrethrin Content of Pyrethrum.**—*Soap* **14** no. 11 pp. 101–103, 2 refs. New York, N.Y., November 1938.

This paper comprises a description of a method of isolating pyrethrin II [*R.A.E.*, A **24** 213] and an account of experiments of which the

following is the authors' summary : Experiments were conducted to determine the effect of preliminary aqueous extraction of pyrethrum flowers on the percentage of pyrethrins in the subsequent petroleum ether extracts. Pyrethrum flowers lose about one-third of their weight when extracted by water. The aqueous extract contained a negligible amount of pyrethrins and, although the extract was toxic to goldfish, it was not toxic to the housefly. Extraction of pyrethrum flowers by water followed by drying the marc in a steam cabinet causes a decrease in the amount of petroleum ether extract that is subsequently obtained. The pyrethrin content of this oleoresin remains about the same as that of the untreated flowers, or even less, which indicates that some of the pyrethrins are destroyed by such a treatment. Consequently this process is unsuitable for increasing the percentage of pyrethrins in the flowers or in the petroleum ether extracts.

PYENSON (L.). **Notes on the Biology of the Cotton Borer in Pernambuco, Brazil.**—*J. econ. Ent.* **31** no. 5 pp. 553–557, 4 figs., 11 refs. Menasha, Wis., October 1938.

A weevil of the genus *Gasterocercodes* that is evidently indigenous has become one of the major pests of cotton in the north-eastern states of Brazil. Examination of specimens from Pernambuco has shown it to be a variety of *G. brasiliensis*, Hambleton, which was described from São Paulo [*cf. R.A.E.*, A **26** 115, 502], though, like the latter, it was originally thought to be *G. gossypii*, Pierce. It attacks all varieties of cotton ; its wild food-plants in Pernambuco have not been ascertained, but it has been recorded on *Hibiscus esculentus* in Bahia.

The adults in Pernambuco are negatively phototropic and pass the day concealed on the cotton plants or in débris beneath them. They are active at night and feed on the leaves, petioles and bark, but not to a sufficient extent to do much harm. Normally, the females lay their eggs in the bark of the main stems at the level of the soil or a little below in the rainy season, but higher up around the axils of the branches in the hot dry season. Adults do not attack seedling plants, but have attacked young plants with roots large enough to accommodate only one larva, though older plants are preferred. The eggs hatch in a few days, and the larvae begin boring downwards spirally in the cambium layer of the root and sometimes into the xylem. Vigorous plants form cambial growths over the tunnels. These often save the plant, but are preferred by the adults for oviposition, and larvae burrowing in them cause them to enlarge still more ; many plants are so weakened by these repeated attacks that they die. In the stems, feeding takes place in the cambium and later sometimes in the pith, the swellings develop here also and are accompanied by a gummy secretion. Attacked stems are usually broken by the wind. The larval tunnels are always filled with frass. The larval stage lasts about a month in the dry season and much longer in the cooler rainy season. Pupation takes place in cells in the xylem of the root or the pith of the stem, and the pupal stage lasts 7–10 days. The adults bore their way out of the roots and emerge from the soil. The period from egg to adult lasts about 5 weeks in the dry season and 2 months or more in the rainy season. Reproduction is continuous throughout the year, and there are no definite generations. As a result of attack the plants cease growth, and the leaves change from dark green to

reddish yellow, and then fall. If the plants remain alive, a poor crop of bolls is produced earlier than would otherwise be the case. Over half the plants in many fields die prematurely, and frequently nearly all are infested by harvest time. Laboratory experiments showed that damp soil was not attractive to the adults as a hiding place. Adults confined with dry soil were all dead within 9 days, some confined with wet soil were all dead within 19 days and of some confined with dry soil and green food the first died after 21 days and two were still alive after 4½ months.

Only 4 out of 15 adults confined with leaves sprayed with 0·5 per cent. suspension of lead arsenate were dead at the end of a week in the laboratory, but all of those confined with leaves sprayed with Paris green at the same strength were dead after 48 hours. In field experiments in which adults were caged on plants that had been sprayed with the two arsenicals at the same concentration, 11 out of 44 weevils in the lead arsenate tests were dead at the end of a week and 27 out of 30 in the Paris green tests were dead at the end of two days. *G. brasiliensis* has few parasites and predators. Three Braconids [**25** 509] and one Chalcidoid [**25** 510] attack it in São Paulo, and the author has reared an unidentified Chalcidoid from it in Pernambuco. Cultural methods of control are the most satisfactory. They consist in clean culture in the case of perennial cotton, and in the case of annual cotton, planting early in the rainy season, the establishment of cotton on suitable soil only, the use of varieties that are suitable for the region and mature early, the immediate burning of all infested plants, early harvesting and immediate burning of plant waste followed by ploughing of the field, which should then lie fallow, and destruction of growth around the fields at the beginning of the dry season and of all cotton that springs up during it.

HYSLOP (J. A.). **Giving Meaning to the Terms, Brood and Generation.** —*J. econ. Ent.* **31** no. 5 pp. 557–559. Menasha, Wis., October 1938.

The author quotes dictionary definitions of the words "brood" and "generation," reviews the meanings attributed to the terms by various entomologists, suggests how, in his opinion, they should be used, and recommends the appointment of a committee of entomologists to consider the matter.

HEADLEE (T. J.) & JOBBINS (D. M.). **Progress to Date on Studies of Radio Waves and related Forms of Energy for Insect Control.**— *J. econ. Ent.* **31** no. 5 pp. 559–563. Menasha, Wis., October 1938.

In continued studies on the use of radio waves and related forms of energy for the control of insects [*cf. R.A.E.*, A **24** 424, etc.], modulation by interruption of current had no lethal effect on adults and larvae of *Tribolium confusum*, Duv., which were never killed until the whole wheat in which they were kept reached a lethal temperature. A small amount of moisture increased the speed with which heat was developed in soil, while a large amount decreased it, and the composition of the soil (washed quartz sand, a ceramic clay and a mixture of sand, loam and humus) influenced the rate of heat production differently at different moisture contents. The optimum moisture content for promoting increase in heat was 2·5–5 per cent. Third-instar larvae of

Popillia japonica, Newm., in sandy loam with 10–15 per cent. moisture kept at 79–80°F. for two days and then submitted to treatments made at 4,838,000 cycles and 3,660 volts potential per inch, all died when the temperature was brought up to 120–122°F. or more, and eggs under the same conditions treated at 4,800,000 cycles per second and 3,660 volts potential per inch failed to hatch when the temperature was raised to 120°F. or more. However, when the soil balls round six species of plants were treated, the plants were killed or very seriously injured as soon as the temperature of the soil reached a point lethal to the larvae.

Extended observation showed that when insects of various species are placed 10–12 ins. away from the source of energy and subjected to the rays of a 260-watt incandescent therapeutic lamp fitted with the ordinary type of therapeutic reflector, they are generally killed, whereas they are not killed when subjected to the rays from a white light Mazda lamp of the same wattage or from a 450-watt quartz mercury lamp. Difference in penetration of the insects by the energy from different sources was found to be responsible, an experiment showing that the transmission rate of energy from the incandescent therapeutic source was 2–6 times as great as from quartz mercury. In an investigation of the penetration of the different sections of the spectrum covered by these two energy sources, transmission was lowest in the ultra-violet and increased as the waves grew longer. The penetration of energy from the infra-red section of the therapeutic lamp through certain cereal products was materially greater than from the mercury quartz lamp, but a very thin layer of these materials over the insect would be sufficient to protect it from injury.

Smith (R. C.). **Some Phases of Entomological Writing from the Viewpoint of the Reader.**—*J. econ. Ent.* **31** no. 5 pp. 563–565, 5 refs. Menasha, Wis., October 1938.

The author emphasises the need of a sufficient critical review of the literature in scientific papers to enable the reader to correlate any new facts with previous knowledge, and discusses methods of referring to papers in a bibliography. He also advocates the addition of an adequate summary to every paper, and the preparation of summaries of special subjects, as for example, Uvarov's Locusts and Grasshoppers [*R.A.E.*, A **17** 2] and Insects and Climate [**19** 268].

Section of Plant Quarantine and Inspection.—*J. econ. Ent.* **31** no. 5 pp. 577–594, 2 figs., 14 refs. Menasha, Wis., October 1938.

The papers in this section include : Dutch Elm Disease Eradication ; Japanese Beetle Control ; European Corn Borer and Gypsy Moth Certification, by E. G. Brewer and W. Middleton (pp. 577–583), in which are reported a reduction of 25 per cent. in the number of elms confirmed as infected with Dutch elm disease [caused by *Ophiostoma ulmi*] in the United States in 1937, progress in the eradication of the Japanese beetle [*Popillia japonica*, Newm.], and routine work to conform with quarantines against the corn borer [*Pyrausta nubilalis*, Hb.] and the gipsy moth [*Lymantria dispar*, L.] ; Grasshopper Outbreaks in Iowa, by C. J. Drake and G. C. Decker (pp. 583–586), in which outbreaks of grasshoppers that are known to have occurred in Iowa since the late eighteenth century are reviewed and a report is made of the state of infestation in 1937 [*cf. R.A.E.*, A **26** 23], when a spring population sometimes reaching 1,000 nymphs per sq. yd.

and favourable weather conditions contributed to build up a larger population of eggs in the soil in the autumn than at any time during the current outbreak; Gypsy Moth and Brown-tail Moth Control Operations during 1937, by A. F. Burgess (pp. 587–589), in which suppression and control work on *Lymantria* (*Porthetria*) *dispar* and *Nygmia phaeorrhoea*, Don., carried out during the year ended 30th June 1937 is described; and The Present Status of the Japanese Beetle Situation in St. Louis, by J. C. Dawson (p. 590), in which it is reported that in 14,750 traps set for *P. japonica* in St. Louis in 1937 [*cf. loc. cit.*], only one beetle was caught.

Pearce (G. W.) & Avens (A. W.). **The Ratio of Lead to Arsenic in Spray Residues from Lead Arsenate.**—*J. econ. Ent.* **31** no. 5 pp. 594–597, 5 refs. Menasha, Wis., October 1938.

The following is mainly the authors' summary: The ratios of lead to arsenic (arsenious oxide) in residues from lead arsenate sprays applied under conditions prevailing in New York tend to be higher on apples at harvest than the ratio in diplumbic lead arsenate. The tendency is more pronounced in residues that have been exposed to long periods of weathering. It is shown that the reactions between lead arsenate and water, Bordeaux mixture, lime-sulphur or wettable sulphur, of which the first is usually present in the form of rain or dew and the remaining three are often applied as fungicides at the same time as lead arsenate, tend to reduce arsenic more than lead. The tendency for the ratio of lead to arsenic to increase is less pronounced when oil has been applied with or following the lead arsenate sprays. The ratio of lead to arsenic in residues on fruit washed with hydrochloric acid with or without wetting agents is definitely higher than that in residues on the unwashed fruit.

Smith (L. M.). **The Relation of Concentration of Active Ingredient to Insecticidal Efficiency of Dusts.**—*J. econ. Ent.* **31** no. 5 pp. 598–602, 4 figs. Menasha, Wis., October 1938.

Tests to determine the relation between the concentration of the active principle and the efficiency of an insecticidal dust were carried out with barium fluosilicate diluted with talc against *Oecanthus niveus*, DeG., on raspberry leaves, and indicated that dilute dusts are much more effective per unit of poison than concentrated dusts. From a graph prepared from data obtained in toxicity experiments, the amount of pure barium fluosilicate per 52 sq. ins. needed to give complete kill was found to be 6·6 mg. The amounts of 80, 50 and 30 per cent. dusts required to give complete mortality, computed on the theory that the same amount of pure barium fluosilicate is needed, regardless of concentration, are 8·25, 13·2 and 22 mg., whereas on a curve based on the experimental data, they are 7·85, 10·25 and 12·5 mg. *O. niveus* does not ingest poison while feeding, but in cleaning its legs. The food in these tests consisted of ripe, undusted raspberries.

Shotwell (R. L.). **Species and Distribution of Grasshoppers responsible for recent Outbreaks.**—*J. econ. Ent.* **31** no. 5 pp. 602–610, 6 refs. Menasha, Wis., October 1938.

Outbreaks of grasshoppers in the United States between 1917 and 1937 are reviewed, the abundance of various species in certain states

in different years is compared, and changes are shown to occur in the relative importance of some of the major economic species from non-outbreak to outbreak years. Outbreaks are shown to be formed by a natural building up of the population and not by sudden invasion. Studies in the fluctuation of grasshopper populations are being conducted in nine general areas of natural vegetation to investigate the effect of large-scale changes of flora and ecological conditions through cultivation and grazing.

SALMAN (K. A.). **An unusual Type of Top-kill of Ponderosa Pine.**—*J. econ. Ent.* **31** no. 5 pp. 613–616, 1 fig., 1 ref. Menasha, Wis., October 1938.

During 1935, injury to the tops of ponderosa pine [*Pinus ponderosa*], which is described and compared with other types of top-killing, was prevalent in several forested areas in California. Little new injury was found in these areas in 1936, but a limited amount of the same type was seen in several new areas. Examination of infested trees showed that *Pityophthorus confinis*, Lec., and *P. confertus*, Sw., which are not known to have been previously recorded as causing similar damage, were, with few exceptions, the only species of insects concerned. The attacks appeared to be normal, the usual stellate brood burrows being formed, and the larvae appearing normal in size. The presence of young adults showed that the broods had been successful. No pitch tubes were found, and only a few attacks were unsuccessful. The bole of each tree that was felled was examined for injuries other than those resulting from the attacks of *Pityophthorus* which might have weakened the trees, but none was observed.

BILLINGS (S. C.). **Mothproofing Preparations and Methods of Testing.**—*J. econ. Ent.* **31** no. 5 pp. 616–618, 2 refs. Menasha, Wis., October 1938.

The materials sold for making woollen goods proof against damage by clothes moths belong to two general classes, inorganic salts dissolved in water and more or less complex organic substances carried in a light petroleum fraction or other organic solvent. The effectiveness of the compounds in the first group when woollens are thoroughly impregnated with them is unquestioned, and though usually reduced or destroyed by washing, is not impaired by dry-cleaning, ironing or exposure to sunlight, but the substances are poisonous and their use in clothing has been condemned by some authorities. At least two-thirds of the organic compounds on the market have been found to lack moth-proofing value, and dry-cleaning and long exposure to sunlight reduces the value of many that are otherwise effective. The method used by the United States Department of Agriculture, Food and Drug Administration, to test the effectiveness of these products against *Tineola biselliella*, Humm., and *Tinea pellionella*, L., is described in detail.

SMITH (R. C.). **Annual Insect Population Records, with special Reference to the Kansas Summary.**—*J. econ. Ent.* **31** no. 5 pp. 618–622, 8 refs. Menasha, Wis., October 1938.

Because of the desirability of being able to foretell outbreaks or the occurrence in unusual numbers of injurious insects, and the necessity,

to provide the information to make forecasts, of annual records of populations of insects correlated with weather, diseases, parasites, predators and crops for limited areas over a number of years, a brief report is presented on surveys now being made in the United States, Canada and Porto Rico, compiled from answers to a questionnaire, and the various methods that are being used to gather information are discussed. A comparable annual record of insect abundance, including records of both scarcity and absence, the effect of climate, the population of natural enemies and other controlling factors, sufficiently detailed and extensive to allow of long-period studies, is not being prepared in many states. Such records have been kept in Kansas since 1931 [*R.A.E.*, A **26** 184, etc.]. The method used, which, it is thought, could be developed into one superior to any employed elsewhere, is described, and its advantages and disadvantages are discussed.

Underhill (G. W.) & Cox (J. A.). **Studies on the Resistance of Apple to the Woolly Apple Aphid,** *Eriosoma lanigerum* **(Hausm.).**—*J. econ. Ent.* **31** no. 5 pp. 622–625, 3 figs., 2 refs. Menasha, Wis., October 1938.

An account is given of experiments carried out in Virginia during 1935–37 to determine the resistance of the roots of 20 varieties of apple to *Eriosoma lanigerum*, Hsm. [*cf. R.A.E.*, A **16** 112, etc.]. A resistant variety is defined as one on the roots of which the Aphids established temporary infestations, but did not reproduce or stimulate the formation of galls. The technique by which the growth of roots on the scion was stimulated and the roots were artificially infested is described. Early Harvest and Northern Spy, which was used as control, were the only varieties found to be resistant.

Kearns (C. W.) & Compton (C. C.). **The Control of Common Red Spider and Thrips by the Use of N,N Amyl Benzyl Cyclohexylamine.** —*J. econ. Ent.* **31** no. 5 pp. 625–630, 3 figs., 2 refs. Menasha, Wis., October 1938.

N,N-amyl-acetyl cyclohexylamine and N,N-amyl-benzoyl cyclohexylamine, which are extremely effective as sprays against *Tetranychus telarius*, L. [*R.A.E.*, A **25** 433], were found to be rather phytotoxic. It was determined that this was chiefly due to the acyl group. This was demonstrated when it was found that N,N-amyl-benzyl cyclohexylamine (C.P. 100) [**25** 696] was more active as an insecticide than N,N-amyl-benzoyl cyclohexylamine, its corresponding acyl derivative, and only one-third as active as a phytocide. Its physical and chemical properties are given. It is insoluble in water, and its toxicity varies greatly with the emulsifying agent used. The most successful was Santobane A Emulsifier, which is being produced for the specific purpose of use with this substance and rendered it about twice as effective as it was when emulsified with Albasol [**25** 696]. The formula used was 30 per cent. emulsifier to 70 per cent. N,N-amyl-benzyl cyclohexylamine, and the dilutions given are dilutions of this formula. At dilutions of 1–600 or less, no wetting agent is needed. Toxicity experiments were carried out on *T. telarius* on roses and *Thrips tabaci*, Lind., on chrysanthemum. A method of keeping sprayed leaves turgid without allowing the surface to become wet is described and was used for experiments on the mobile stages. Experiments on the

immobile stages were made on potted plants. On the basis of the laboratory tests, it was judged that a thorough application at 1 : 400 should produce 96–100 per cent. mortality of mobile stages of *Tetranychus* and about 75–80 per cent. mortality of the eggs. Practical tests corroborated the results obtained in the laboratory. *Tetranychus* was satisfactorily controlled by applications at this dilution on 16 varieties of rose in commercial greenhouses, without injury to the plants. Effective control was also given at 1 : 600, though only a small percentage of eggs were killed. When development of the mite is at its peak, applications should be repeated every 24 days at 1 : 400 or every 18 days at 1 : 600. One application at 1 : 400 followed 5 days later by one at 1 : 600 kept the plants free from injurious infestation for 30 days. In tests on cucumbers and 6 kinds of ornamental plants in the greenhouse, 96 per cent. control or over, without injury to the plants, was given by various dilutions greater than 1 : 600. It was possible to control *Thrips tabaci* on chrysanthemum satisfactorily by making two applications at an interval of a week at 1 : 1000 with 0·05 per cent. by weight of an alkylated benzene sodium sulphonate as wetting agent.

McKinney (K. B.). **Physical Characteristics on the Foliage of Beans and Tomatoes that tend to control some small Insect Pests.**—*J. econ. Ent.* **31** no. 5 pp. 630–631. Menasha, Wis., October 1938.

During April 1937, string beans in Arizona became heavily infested with winged adults of *Myzus persicae*, Sulz., which immediately began to breed, but by the end of the first week in May the infestation had decreased and large numbers of dead nymphs and adults were observed. A close examination showed that these had become impaled on the recurved spines on the foliage. Larvae and adults of several species of thrips were also impaled, but not to so great an extent. The factors that may contribute to causing small insects to become impaled are discussed. It is suggested that entanglement of the insects in a gumlike secretion from the foliage may account for the disappearance of *M. persicae* and *Frankliniella tritici*, Fitch, from tomato plants that also became infested in April.

Smith (L. E.). **Toxicity of Ether-soluble and Ether-insoluble Fractions of commercial Phenothiazine to certain Insects.**—*J. econ. Ent.* **31** no. 5 p. 631, 5 refs. Menasha, Wis., October 1938.

In consequence of experiments with thiodiphenylamine (phenothiazine) in the laboratory [*R.A.E.*, A **23** 652; B **23** 119], this compound was tested in the fields in 1934 against the codling moth [*Cydia pomonella*, L.], but the results obtained were not promising. Chemical examination of the compound used showed that when it was extracted with ether in a Soxhlet apparatus, a fractionation was obtained. The ether-soluble part was as toxic to larvae of *C. pomonella* as pure thiodiphenylamine, but the ether-insoluble part was relatively non-toxic. Tested against mosquito larvae by D. E. Fink, the ether-insoluble fraction at concentrations of 0·005–1·0 per cent. in water gave no kill, while the ether-soluble fraction gave complete kill at all tested concentrations over this range, a result comparable to that obtained when pure thiodiphenylamine was used.

Potts (S. F.). **The Weight of Foliage from different Crown Levels of Trees and its Relation to Insect Control.**—*J. econ. Ent.* **31** no. 5 pp. 631–632. Menasha, Wis., October 1938.

A study of leaves from different crown levels of several species of trees showed that the leaves from the upper part of the crown are heavier per unit area than those from the lower part. In the case of red oaks, the difference was less when the trees were growing in the open than when they were dense, whereas in the case of white pine [*Pinus strobus*] the reverse was true. Generally, leaves from the upper part of the crown of deciduous trees were smaller in area, but needles from the upper part of the crown of conifers were longer than those from the lower part. Since the effectiveness of stomach poisons against insects that consume the whole or large parts of leaves depends upon the quantity of poison per given weight of foliage, rather than per given area, the weight of the foliage is of primary importance. When spray is applied from the ground, more insecticide is usually deposited per unit of leaf area on the lower than on the upper part of the crown. This difference is even greater on the basis of leaf weight. Larvae of *Lithocolletis* sp., *Fenusa pusilla*, Lep., and *Phyllotoma nemorata*, Fall., are found more frequently, and their mines are larger in thick than thin leaves. Larvae of *Lymantria* (*Porthetria*) *dispar*, L., and *Ellopia athasaria*, Wlk., fed on foliage from the top of the crown became heavier than those fed on foliage from the lower part.

Townsend (C. H. T.). **Note on the attempted Establishment of *Paratheresia* in Louisiana.**—*J. econ. Ent.* **31** no. 5 p. 632. Menasha, Wis., October 1938.

The author considers that *Theresia* (*Paratheresia*) *diatraeae*, Brèthes, and *T.* (*P.*) *signifera*, Tns., are both valid species and that the fact that they have been considered synonyms of *T.* (*P.*) *claripalpis*, Wulp [*cf. R.A.E.*, A **17** 311, 656; **18** 677] has led to the failure of attempts to introduce what was thought to be the latter into Louisiana [**26** 391]. He states that the fly of which the introduction was attempted was really *T. signifera*, which is an arid-region species that cannot readily adapt itself to humid conditions, while the reverse is the case with *T. claripalpis*, which would certainly become established if introduced from Mexico. He considers that the species of the genus found in Florida in 1936 [**26** 391] was probably the subhumid *T. diatraeae*, which may have been present in the Florida liberation. It is less likely to be an indigenous species, as it has not been found in Louisiana or Cuba, but if it is indigenous, it would be worth while to attempt to establish it in Louisiana. He also considers that it is desirable to regard *Paratheresia* as generically distinct from *Theresia*.

Smith (R. H.). **Microtechnique Method of testing Oil Insecticides on Scale Insects.**—*J. econ. Ent.* **31** no. 5 pp. 632–633. Menasha, Wis., October 1938.

A method of testing oil insecticides used against Coccids with greater precision than can be attained by orchard experiments is described. The oil is placed directly into the spiracle or upon any

desired part of the body of the insect, and the effect determined by observation under the microscope. In the case of armoured scales, individuals in the late second or early third instar are selected, the armour is removed, the stylets are pulled out of the food-plant or partly pulled out and cut off, a thin smear of adhesive is applied to a slide, and the insects are placed on the smear with their dorsal surface in it. The oil is applied with a fine spine of *Opuntia*, attached to the end of a dissecting needle, to the desired part under a compound microscope. When the application is to be made to the spiracle, a sketch of the adjoined tracheae is first made because the tracheae become more or less invisible when filled with oil. After the application, the extent of oil penetration is indicated on the sketch. Additional sketches are made to show the movement of the oil as affected by the efforts of the insect to eject it. After the applications have been made, the slide is placed in a petri dish with a wad of moist cotton-wool and kept in subdued light. Under this condition, untreated insects may be kept alive for several days. The Coccids react in various ways according to the effect of the treatment. There is usually no general body movement when highly refined oil is introduced into the spiracles. Oil that contains pyrethrum produces spasmic movements in the region to which it is applied. The progress of lethal effect may be judged by the intensity and the rate of movement of the salivary pump. With the approach of death, faint movement may be induced by reflecting light of high intensity on the insect.

FLANDERS (S. E.). **The Effect of Cold Storage on the Reproduction of Parasitic Hymenoptera.**—*J. econ. Ent.* **31** no. 5 pp. 633–634, 5 refs. Menasha, Wis., October 1938.

Temperatures just below those that permit continuation of development are considered to be the optimum for the storage of parasites ; in some cases, however, they may insure the survival of the individual, but so affect its reproductive organs that it cannot breed [*cf. R.A.E.*, A **22** 361 ; **23** 744]. Parasites are usually placed in cold storage as mature larvae or pupae, when metabolic activity is dependent on nutritive material accumulated during the immature larval stage. If storage is prolonged, the parasite may not have sufficient material to complete its development, and the reproductive organs are the most likely to be affected. The germ cells which undergo their greatest development during the pupal and adult stages appear to be adversely affected ; the spermatozoa in particular seem to lack vitality. Examination showed that fat cells were abundant in normal adults of *Tetrastichus* sp., whereas in others that had been in cold store for two weeks as pupae, they were scarce. In 1938, several thousand individuals of *Tetrastichus* sp., a parasite of the eggs of the elm leaf beetle [*Galerucella luteola*, Müll.] introduced into California from Japan, were reared and released. The parasites, apparently in all stages of development, were 14 days in transit at a temperature of about 38°F. The host did not survive shipment, but there was little, if any, mortality among the parasites. Dissection of the reproductive organs of adults of both sexes revealed that the vesiculae seminales of the males were filled with spermatozoa, but the viability of the spermatozoa varied in different individuals, as they were very active in some and sluggish or inactive in others. The spermatheca in each of the females appeared to be devoid of sperm,

although there had been opportunity for pairing. However, the progeny included some females, showing that either pairing had occurred or the species is deuterotokous. It is possible that if Hymenopterous parasites were stored either as immature larvae or as adults and the temperature were raised at regular intervals for short periods of normal feeding and respiration, their reproductive capacity would be unimpaired.

Kvičala (B.). **Škody způsobené minujícím hmyzem rostlinám na Kroměřížsku.** [Injuries caused by Mining Insects to Plants in the District of Kroměříž.]—*Folia ent.* **1** fasc. 2 pp. 141–156, 5 figs. Brno, 1938. (With a Summary in French.)

A list, arranged by food-plants, is given of 164 species of leaf-mining insects obtained from 191 different plants in central Moravia.

Gregor (F.). **Dva parasiti současně v jednom hostiteli.** [Two Parasites occurring simultaneously in one Host.]—*Folia ent.* **1** fasc. 2 p. 162. Brno, 1938.

Larvae of an unidentified Hymenopterous parasite were found in a pupa of *Malacosoma* (*Clisiocampa*) *neustria*, L., after an adult of *Theronia atalantae*, Poda, had emerged from it in September 1938. The pupa was one of a number collected in the Moravian Mountains. *T. atalantae* was abundant in 1925 in Ruthenia, where it parasitised *Aporia crataegi*, L.

Rubtzov (I. A.). **Рубцов (И. А.). The theoretical Basis of the Distribution of harmful Insects and of Predictions as to their Mass Multiplication. I. Conception of Plasticity, its Rôle in the Dynamics of the Abundance of Insects and Methods of studying it.** [*In Russian.*].—*Plant Prot.* no. 14 pp. 3–13, 20 refs. Leningrad, 1937. **II. Integral climatic Indices for Purposes of Zonation and Prognosis of Mass Propagation of Pests.** [*In Russian.*].—*Op. cit.* no. 16 pp. 3–21, 5 maps, 26 refs. 1938. (With a Summary in English.)

In the first paper, the author points out that the normal development of an insect is possible not only in the zone of optimum conditions, but also in certain zones adjoining the optimum one, the width and character of which indicate the ecological plasticity of that insect, or its ability to withstand the fluctuations in external conditions. The abundance of a species is determined not so much by its fertility or length of life as by its ecological plasticity, and most of the injurious insects of which mass outbreaks are periodic have a wide geographical range, are either polyphagous or feed on widespread plant species, and are physiologically plastic. Even when the abundance of a species is limited by biotic factors, the relation between the host and the parasite or other natural enemy is again determined by their respective ecological plasticities. Thus, grasshoppers in Siberia and the Hessian fly [*Mayetiola destructor*, Say] in the Ukraine are themselves favoured by moderately humid conditions, but are most numerous during the dry years, for the fungi which infest the eggs of the grasshoppers and the Hymenopterous parasites of the fly are less plastic in their humidity requirements than their hosts. Thus, although the approach of natural conditions to the physiological optimum may lead to mass outbreaks

of a species, its dynamics are determined by the sum total of ecological conditions, and distinction should be made between physiological and synecological optima, which do not always coincide.

There can be no general rule that plasticity with regard to any particular set of factors is the most advantageous, for the abundance of a species will be determined by those physiological peculiarities that are the least plastic with regard to environmental fluctuations. Among external factors, those that deviate most frequently from the normal limits will be the most important. To determine the possibility of the mass outbreaks of a given species and to forecast them, it is essential to know the limits of its plasticity. This knowledge can be obtained by mapping its distribution area and discovering the climatic indices characteristic of them, supplemented by intensive field and laboratory investigations.

In the second paper, an attempt is made to establish characteristic correlations between the distribution of climatic factors, and of given species, and between their fluctuations. Hydrothermic coefficients serving as indices of humidity conditions in given localities were obtained by the formula $P \div E$, where P is the average annual precipitation in millimetres and E is the sum of average monthly temperatures above 6°C. for the warm half of the year [*cf. R.A.E.*, A **24** 354]; and a thermal index was obtained by summation of the average daily temperatures over 10°C. for the whole year. The lines of equal hydrothermic coefficients (isopotids) and of equal temperature sums are plotted on maps of Russia in Europe and in Asia, and were found to coincide with the limits of many soil and vegetation belts and of the distribution areas of some rodents and injurious insects. To increase the accuracy of this method, temperatures of the threshold of development for different species should be substituted for 6°C. and 10°C. in the above formulae.

The distribution of *Pyrausta nubilalis*, Hb., is delimited by isopotids 3 and 16; it is most injurious between isopotids 8 and 10, at a temperature sum of 2200°C. in most of European Russia, and between isopotids 12 and 14 at a temperature sum of 4000 in the northern Caucasus and on the Black Sea coast, where it passes through two generations a year. The zones of injurious activity of *Loxostege sticticalis*, L., and of *Heliothis armigera*, Hb. (*obsoleta*, F.) lie between isopotids 6 and 10, and 4 and 6, at temperature sums of 2000 and 3500–4000, respectively. The northern centres of injurious activity of *Agrotis segetum*, Schiff., are delimited by isopotids 18 at a temperature sum of about 1600 and 13–15 at a temperature sum of not over 2000; the southern centres, where there are two generations a year, lie between isopotids 7 and 9, at a temperature sum of about 3000. Similar limits are also given for some species of wireworms and of Acridids. The zone of greater density of *Agriotes sputator*, L., is delimited by isopotids 13–14 in the north and 6 in the south, at temperature sums of 2000–3000. The northern limit of the distribution area of *Locusta migratoria*, L., coincides with isopotid 16, at a temperature sum of 2000. It becomes a pest between isopotids 8 and 9, at a temperature sum of 2500 or more. The reservations of *Aeropus sibiricus*, L., are delimited by isopotid 8 [*loc. cit.*]. During the outbreak years of 1896–99 in the Nizhneudinsk district of eastern Siberia, the coefficient of humidity over a large area decreased from 14–12 to 9–6, and the favourable habitat was greatly extended. Similar phenomena were observed in

eastern Siberia during the 1923–1927 outbreak. In Kazakstan, however, where the mass outbreaks are limited by lack of humidity, they occur in relatively humid and cool years when the coefficient of humidity rises from 6 to 8 or 9.

[Shevchenko (M. I.).] **Шевченко (М. И.). Revealing Seed Pests by Means of X-Rays.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 14–25, 1 ref. Leningrad, 1937. (With a Summary in English.)

In view of the successful use of X-ray photographs to detect larvae of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in cotton seeds [*R.A.E.*, A **21** 22], experiments with this method were undertaken in Leningrad in 1936. Radiographs were made of the seeds of 33 different species of cultivated crops and forest trees, and infestation by 20 species of pests was detected. The technique of the process is described. In the case of *Bruchus pisorum*, L., up to 31·8 per cent. more infested peas were revealed by the radiographs than by external examination, and they rendered it possible to detect the mines of young larvae in peas that were artificially infested in the laboratory, which indicates that infestation could be determined immediately after the harvest. The process of radiation did not affect the germinative power of the seeds.

[Stepantzev (I. N.).] **Степанцев (И. Н.). A Prognosis of the Rate of Development of the red Spider depending on meteorological Conditions.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 22–26, 4 refs. Leningrad, 1938.

With a view to studying the dependence on meteorological conditions of the seasonal variations in population of the red spider on cotton in eastern Uzbekistan [*Tetranychus turkestani*, Ugar. & Nik. (*R.A.E.*, A **26** 530)], records made in a district in Ferghana of the mean day temperature and relative humidity during April–September in the years 1935 and 1936 were compared with the averages of those obtained in the same district in 1931–36. On the basis of these data and the mean daily temperature and humidity conditions that are most favourable for the mite [**25** 311], the author has evolved an improvement of his previous formula [*loc. cit.*] by means of which it is possible to determine to what extent the meteorological conditions of a given year are favourable to an increase of infestation and to forecast the probable abundance of the pest and the rapidity of its development.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Studies on the Effect of Heat on the Development of the Pupae of the Cotton Bollworm *Heliothis obsoleta* F.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 27–34, 1 graph, 16 refs. Leningrad, 1938. (With a Summary in English.)

An account is given of laboratory investigations on the effect of temperature and humidity on the pupae of *Heliothis armigera*, Hb. (*obsoleta*, F.), a summary of which has already been noticed [*R.A.E.*, A **26** 472]. The strain of the Noctuid used was obtained from material collected in Azerbaijan. The temperature-sums necessary for the development of the pupae are now stated to be 179 day-degrees C. [322·2°F.] for the hibernating generation and 201 [361·8] for the summer one, the respective thresholds of development being 15·5°C. [59·9°F.] and 11°C. [51·8°F.]. The thermal optimum lay

between 20 and 25°C. [68–77°F.]. The average duration of development of the pupae of the summer generation decreased from 36·6 days at 17·1°C. [62·78°F.] to 13 days at 25°C. [77°F.]. The duration for pupae of the hibernating generation was longer ; it was sometimes twice as long at 17·1°C., but the difference was less pronounced at 25°. The effect of humidity was only studied on the pupae of the hibernating generation. At 25°C., pupal development at humidities of 25 and 100 per cent. was completed in 16–26 and 15–22 days, respectively. Both high and low humidity, however, increased the percentage mortality, which was 38 at 25 per cent. humidity, 34·1 at 100, and lowest (23–29) at 50–60. The greatest numbers of eggs (up to 3,132) were laid by moths from pupae that had developed at 50 per cent. humidity. The average longevity of the moths varied according to the temperature at which the pupae had been kept ; it was 4·4, 12·3 and 8·2 days, respectively, for moths from pupae kept at 32·3, 20·4 and 17·2°C. [89·96, 68·72 and 62·96°F.].

[Bugdanov (G. B.).] **Бугданов (Г. Б.). The Use of *Trichogramma evanescens* Westw. for the Control of the Corn Borer.** [*In Russian.*] —*Plant Prot.* no. 16 pp. 35–40, 1 diagr., 9 refs. Leningrad, 1938.

Pyrausta nubilalis, Hb., is the chief pest of maize in the northern Caucasus [*cf. R.A.E.*, A **24** 674], and continued experiments on its control by means of *Trichogramma evanescens*, Westw. [*cf.* **25** 152] were carried out in 1936 in a district in which the parasite did not occur naturally. Oviposition by the moth continued from early July till about mid-August, but reached its peak between 25th and 30th July. A total of 1,500 cards, on each of which were 1,000 parasitised eggs, were tied in pairs in paper bags to 750 plants over an area of 37 acres on 20th July, and 1,500,000 adult parasites were liberated on 22nd July on 750 plants in an adjoining area of the same size. The first parasitised egg-batches in the field were found on 24th July in the first area and on 25th July in the second. The percentages of infested stems in fields in which adults and eggs had been liberated and in the controls were 16, 24 and 48, respectively, on 16th August, 29, 43 and 62 on 21st August, and 42, 48 and 73 at harvest on 10th October. The average numbers of larvae per stem at harvest were 1·3, 1·5 and 1·8. In the fields in which *Trichogramma* was released, the average number of cobs per plant and the yield per acre were 1·75 and 1·85 per cent. greater than in the controls, and the losses caused by the borer in the yield of air-dried grain were reduced by 35·5 per cent.

[Vasser (R. E.).] **Вассер (Р. Э.). Sur la biologie et l'écologie des coccides nuisibles aux Aurantiacées sur la côte caucasienne de la Mer Noire.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 41–49, 4 graphs. Leningrad, 1938. (With a Summary in French.)

Of the Coccids attacking *Citrus* in the environs of Batum, on the Black Sea coast [*cf. R.A.E.*, A **24** 761], *Aonidiella citrina*, Coq., *Lepidosaphes beckii*, Newm., and *L. gloveri*, Pack., are the most injurious. Observations on their hibernation and rate of mortality were carried out in the winter of 1932–33 by examining infested leaves taken from mandarin trees. The development of these Coccids apparently ceases during the three coldest months (December–February) and is resumed in spring when the average temperature

reaches 10°C. [50°F.]. *A. citrina* hibernated chiefly as a second-instar larva ; first-instar larvae and adult females occurred in smaller numbers, but no male pupae or adults were observed. The number of young sexually mature females increased at the beginning of March, when there was a spell of warm weather, and again in the second half of April. About 8–12 per cent. of the scales had overwintered as mature females, and these started to oviposit about 10 days before the young ones. Male nymphs appeared at the end of April. *L. gloveri* and *L. beckii* hibernated chiefly as adults and second-instar larvae ; young females and male nymphs were present throughout the winter. Ovipositing females of *L. gloveri* were the most numerous from the end of April and those of *L. beckii* from the middle of May. The percentage mortality in the three species, which at the beginning of November was only 10–25, considerably increased in December and again at the end of February and beginning of March. Maximum mortality, however, occurred at the end of April and in May, when it rose to 89·1, 87·4 and 72·5 per cent. in *L. beckii*, *A. citrina* and *L. gloveri*, respectively. This was evidently due to sharp fluctuations of temperature and the lowered resistance of the scales following the suspension in development during the winter.

Parasites were reared from all three Coccids and included *Aspidiotiphagus citrinus*, Crwf., *Coccophagus lycimnia*, Wlk. (*lecanii*, Fitch), and *Aphytis* (*Aphelinus*) *mytilaspidis*, LeB., from *A. citrina*, and *Prospaltella aurantii*, How., from *L. gloveri*. Pupae of the parasites were observed under the scales from the middle of April, and the adults began to emerge in mid-May. The only one to effect appreciable control was *P. aurantii*, which parasitised up to 80 per cent. of *L. gloveri*. It is possible that the greater economic importance of this Coccid in the district of Sukhum is due to the absence of *P. aurantii* there.

Paĭkin (D. M.). **Пайкин (Д. М.). The black Cyanide Fumigation of *Citrus* Trees under Tent.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 79–89, 4 graphs, 5 refs. Leningrad, 1938. (With a Summary in English.)

The author reviews the ways in which hydrocyanic acid gas may be generated for fumigating *Citrus* trees in tents and the technique of fumigation. The method was first tried in the Russian Union in 1934, and in 1935 the suitability of a powder of Russian manufacture containing calcium cyanide was tested in Abkhazia (on the Black Sea coast). The proportions of its main constituents were estimated as 18·9 per cent. CN, 23 per cent. Cl, 4·8 per cent. C, 31·5 per cent. Ca, and 13·4 per cent. Na. It was applied to *Citrus* trees by scattering it through a fine sieve, attached to a pole, on to the soil or on to pieces of paper or veneer beneath the tree in the tent. The liberation of the hydrocyanic acid gas on a slightly damp surface was completed in 30–60 minutes, whereas on the soil and on dry paper it required 1½ and 2½ hours, respectively. Special laboratory tests showed that the rapidity with which the gas was released increased in proportion to the fineness of the powder ; the amount liberated in an hour, under favourable conditions for decomposition in tents, was not more than 50 per cent. of the potential yield. Small quantities of acetylene, ammonia and hydrogen sulphide were also liberated, but they did not injure the plants ; the powder itself scorched the leaves when brought

into direct contact with them. In experiments under tents, 89–97 per cent. mortality of *Pseudococcus gahani*, Green, and 96–100 per cent. of *Chrysomphalus dictyospermi*, Morg., were given by an exposure for 1 hour at 14°C. [57·2°F.] to a dosage of 4·5 oz. powder per 100 cu. ft. When the dosage was doubled, the mortalities were 97–100 and 100 per cent., respectively; the plants were slightly scorched and there was some shedding of the foliage, but later development continued normally and there was an average yield of fruit. With exposures of 1½, 2 or 4 hours scorching was considerable. Analysis showed that concentrations of 0·6–1·5 oz. HCN per 1,000 cu. ft. killed 90–98 per cent. of *P. gahani* and 96–100 per cent. of *C. dictyospermi* in 1 hour. A concentration of 1·5 oz. was not injurious to the plants. On the whole, *P. gahani* was the most resistant of the Coccids, and *C. dictyospermi* and *Lepidosaphes gloveri*, Pack., were the least so, while *Ceroplastes sinensis*, Del G., and *Pulvinaria aurantii*, Ckll., were intermediate.

A dosage table for tent fumigation with the powder is given for *Citrus* under tents of different sizes.

[Dmitriev (A. K.).] **Дмитриев (А. К.). A new Sulphur Preparation "E".** [*In Russian.*]—*Plant Prot.* no. 16 pp. 90–95, 6 refs. Leningrad, 1938. (With a Summary in English.)

A preliminary account is given of a new preparation of sulphur recently produced in the Russian Union and provisionally named "E". It is prepared by thoroughly mixing 5–25 per cent. ground sulphur with dry clay passed through a screen of 6,400 meshes per sq. cm., and heating the mixture for 1 hour at 160°C. In chemical tests in which the active surface of the sulphur and the rapidity with which the preparations reacted were taken as criteria of their qualitative value, the indices obtained for the mixture "E" were 7–11 times as high as those for pure sulphur. In laboratory experiments on red spider [*Tetranychus*] on leaves of cotton, which were dusted with different sulphur preparations at the rate of 0·2 mg. per sq. cm., the percentage mortalities of mites given in 22, 46 and 70 hours by preparation "E" containing 5 and 20 per cent. sulphur were 11·9, 91·7 and 100, and 7, 92 and 100, respectively, whereas for pure ground sulphur they were 1·7, 38·6 and 93·3.

[Sugak (A.).] **Сугак (А.). On the Study of Pests attacking the non-alkaloid Lupin.** [*In Russian.*]—*Plant Prot.* no 16 pp. 96–99, 7 refs. Leningrad, 1938.

As a result of investigations in Minsk, a variety of lupin has been obtained that may be of great value as a fodder crop, since it contains only 0·023–0·112 per cent. alkaloids, as compared with 1–1·5 in the common blue lupin (*Lupinus angustifolius*) and yellow lupin [*L. luteus*]. As it is planned to cultivate this new variety on a large scale in the Russian Union, a preliminary list is given of 24 species of insect pests observed on it in Minsk in 1934–35, some of which have already been noticed [*cf. R.A.E.*, A **25** 576]. The most important were the Anthomyiids, *Hylemyia* (*Chortophila*) *trichodactyla*, Rond., which infested up to 43·5 per cent. of the young sprouting plants, and *H.* (*C.*) *cilicrura*, Rond., which burrowed in the underground part of the stems in the first half of May, causing them to decay; the weevil,

Sitona crinita, Hbst., which fed on the foliage and injured 20·1–88·4 per cent. of plants having 2–3 pairs of leaves, and Aphids, of which *Aphis medicaginis*, Koch, was the most common. Plants infested by the Aphids had curled leaves and crooked stems and were often killed. The severity of the infestation was inversely proportionate to the alkaloid content of the plants; the common blue and yellow lupins were not attacked. The Aphids were successfully controlled by spraying twice with soap solution containing anabasine sulphate or nicotine sulphate.

[Ovchinnikova (M. I.). **Овчинникова (М. И.).** *Pediculopsis graminum* **E. Reut. as a pest of Cereal Grasses.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 99–107, 6 refs. Leningrad, 1938.

In the Russian Union, field grasses cultivated for fodder or seed are attacked by a number of insect pests, but the chief damage is caused by mites, of which *Pediculopsis graminum*, Reut., is the most important. The distribution of this mite is reviewed. Field observations near Moscow in 1931 and 1935 showed that female nymphs and adults overwinter, mostly behind the sheath of the upper leaf of old injured stems of grasses and only rarely on young shoots. Females, which are viviparous, produce 82–350 offspring, which may be both nymphs and mature males. Gravid individuals, which occurred up to the beginning of October, contained formless embryos, nymphs and mature males, but hexapod larvae were not observed. The females are fertilised in the nymphal stage, and unfertilised females do not become adult. The mites were most numerous on young shoots in spring and again at the end of summer on grasses sown in June of the current year. Migration to different plots and grasses takes place in the spring, and withering of the flower shoots was observed in the middle of June. The most intense propagation of the mites occurred in the second half of July and in August. Males, which constituted only 2–3 per cent. of the total population, appeared in the second half of August and began to die out in the second half of October.

The infestation of the grasses caused complete or partial white-ear and the yellowing and withering of the central leaf. The mites usually occurred immediately above the upper node of the injured stems, or at a distance of about $\frac{3}{4}$ in. from it. The most heavily infested grasses were *Poa*, *Festuca rubra* and *Agrostis*; rye-grass [*Lolium*] and *Festuca elatior* were only slightly attacked. The mites were favoured by humidity and low temperature, and foci of infestation occurred in comparatively damp places along ditches, roads or edges of fields where the vegetation was not cut regularly. On the other hand, in meadows, even if low-lying and damp, in which the grass was cut annually close to the ground, chiefly at the beginning of July before the mass increase of the mites, hardly any white-ear was observed, as most of the mites remained in the hay and died 4–5 days later. When, however, the grass was cut 8–10 ins. above the ground, many mites remained in the stubble. As the mites do not migrate readily and hibernate mostly in the meadows they have infested during the summer, they gradually increase in abundance the longer the grasses are cultivated for seed.

For control, fodder grasses should not be sown near infested plots, grass on the edges of roads and ditches and along bushes should be closely cut, and infested turf burnt, grasses that are least attractive

to the mites should be cultivated in damp plots, grasses of which the generative stems are severely infested should be cut and not left for seed, and the soil in meadows should be dressed with nitrogenous and potash fertilisers.

[Kabakchi (B. P.).] **Кабакчи (Б. П.). A new Pest of the Sugar Beet—*Ulabasis loricata* Boh.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 107–108. Leningrad, 1938.

At the beginning of August 1935, sugar-beet over an area of about 5 acres in a locality east of Chimkent in southern Kazakstan was attacked by larvae of the weevil, *Ulobaris loricata*, Boh., the infested roots drying up and turning black. Beet cultivated in non-irrigated plots was particularly severely attacked, an average of 20 and a maximum of 80 larvae occurring per root. Pupation started early in September, and adults entered hibernation at the end of October. In irrigated plots, in which the number of larvae per root averaged 2–3, with a maximum of 7, development was more protracted, larvae, pupae and adults occurring simultaneously at the end of October. Observations on weevils kept in cages showed that they feed on the leaves of beet, but prefer those of *Atriplex*.

[Viktorov (V. F.).] **Викторов (В. Ф.).** *Etiella zinckenella* **Tr. as a Pest of Watermelons.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 108–110, 3 figs. Leningrad, 1938.

In July 1936, near Saratov, a larva of *Etiella zinckenella*, Treit., was found in each of two watermelons in plots cultivated between protective strips of deciduous trees including yellow acacia [*Caragana*] and white acacia [*Robinia*], while a few other watermelons had evidently been infested by this Pyralid, which has hitherto been recorded from leguminous plants only. The larvae had tunnelled in the fruits and fed on the seeds, but the fruits showed no external signs of infestation. *Caragana* and *Robinia* in the protective strips had been severely infested, but had dried up owing to hot weather at the time of the appearance of the second-generation larvae, so that some of the latter migrated in search of food.

[Nikol'skiĭ (V. L.).] **Никольский (В. Л.).** *Pyrausta nubilalis* **Hb. as a Pest of woody Plants.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 122–123. Leningrad, 1938.

In August 1935, the upper shoots of willows in a plantation covering $2\frac{1}{2}$ acres in the Province of Voronezh were found to be attacked by the larvae of *Pyrausta nubilalis*, Hb. The infested shoots dried up and finally broke off, and although a bunch of new shoots was produced, the rods were of no value. The percentages of shoots infested were 18–31 in parts of the plantation in which maize was cultivated between the rows of willows, and only 3 elsewhere. Larvae removed from the stems of maize and placed in test tubes with willow cuttings had bored into these on the second day, and larvae taken from willow shoots readily entered maize stems. Single cases of the infestation of the top shoots of poplar were also observed, and infestation of other trees has been recorded previously [*R.A.E.*, A **23** 578].

[Vinokurov (G. M.).] **Винокуров (Г. М.). Frame Determination for the absolute Density of Population of the Grasshoppers and some other Insects.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 127–129, 2 figs., 3 refs. Leningrad, 1938.

Descriptions are given of two frames, one for short grass or bare soil and the other for long grass, that can be pushed over the ground by means of handles so as to disturb grasshoppers over an area of 50 × 50 cm. The number of grasshoppers observed jumping up, multiplied by four, gives the number per square metre. The determinations of density should be made at the times when grasshoppers are fully active.

[Murachev (M.).] **Мурачев (М.). Methods of counting the wintering Stock of *Phyllotreta* spp.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 129–130. Leningrad, 1938.

The numbers of hibernating adults of *Phyllotreta* in a sample of soil can be ascertained by placing the soil in a pail of water and stirring it thoroughly several times. The flea-beetles that rise to the surface together with vegetable débris should be removed and counted after each stirring. In a test in the Province of Yaroslav, known numbers of flea-beetles were placed in containers with live cabbage plants and soil. After they had entered the soil for hibernation, the usual method of examining the soil for their presence was carried out three times, but only 57–61 per cent. were recovered. The soil was then placed into a pail of water and stirred, and the remaining flea-beetles floated to the surface.

[Prutenskiĭ (D. I.).] **Прутенский (Д. И.). The Biology of *Phloeosinus turkestanicus* Sem.** [*In Russian.*]—*Plant Prot.* no. 16 pp. 130–131. Leningrad, 1938.

In the course of observations in 1930 and 1932 in forests in Uzbekistan and Tadzhikistan, respectively, the Scolytid, *Phloeosinus turkestanicus*, Sem., was found infesting different varieties of juniper at altitudes of about 7,000 and 5,000 ft. The infestation was confined to the branches of full-grown trees, but also occurred in the trunks of young ones. The maternal and larval galleries are briefly described. Eggs were found in the galleries on 10th June, and larvae, pupae and young adults in August. Pupation takes place in the sapwood. Mass emergence of the beetles from branches collected in the forest took place in the second half of August. They leave the galleries about a week after emergence, burrow into the young shoots of the trees, usually near the buds, and feed on the heartwood. Infested shoots are easily broken off by the wind.

Storey (H. H.) & Nichols (R. F. W.). **Studies of the Mosaic Diseases of Cassava.**—*Ann. appl. Biol.* **25** no. 4 pp. 790–806, 2 pl., 35 refs. London, November 1938.

Mosaic disease of cassava is widely distributed in tropical Africa and also occurs in Madagascar and Java. Aleurodids of the genus *Bemisia* have been recorded as vectors in the Belgian Congo [*cf. R.A.E.*, A **22** 251], at Amani [**22** 683] and in Nigeria [**24** 636], but it is not yet known whether one or several species transmit the disease. An account is given of experiments carried out at Amani, mainly on the

strains of the mosaic virus and on their transmission [*cf.* **27** 94]. Infection of a plant with a mild strain of virus failed entirely to confer immunity from infection by severe strains introduced by grafting. If the severe strains were inoculated by *Bemisia*, there was an indication of some conferred resistance, but this was insufficient to make the procedure of practical use in control.

POTTER (C.). **The Use of protective Films of Insecticide in the Control of indoor Insects, with special Reference to** *Plodia interpunctella* **Hb. and** *Ephestia elutella* **Hb.**—*Ann. appl. Biol.* **25** no. 4 pp. 836–854, 2 refs. London, November 1938.

The following is taken almost entirely from the author's general summary and conclusions : A series of experiments and a field scale trial have been made of a film spraying method for the protection of stored goods from infestation by *Ephestia elutella*, Hb., and *Plodia interpunctella*, Hb. It appears that reinfestation by these insects in warehouses can be prevented completely, if the goods have been efficiently sterilised before storing. The method is preferred on grounds of expense to the one previously found effective [*R.A.E.*, A **24** 191] in which a mist-spray is applied every night throughout the period of moth emergence.

The procedure is to spray the interior of the warehouse and the cases stored in it with a solution of pyrethrins (0·8 per cent.) in a white oil, the specifications of which are given and which is similar to that used in the previous method [*loc. cit.*]. The apparatus and method of spraying are described. Spraying should begin before the adults emerge (about 15th May in England) and should be carried out twice a week during the period of emergence (which may continue until the end of September). Control is obtained by a protective film of insecticide, which is formed and maintained throughout the period of emergence. A film of about 6–7 mg. of insecticide per sq. in., which is about the amount applied in practice in a single heavy spraying or two light sprayings, on an absorbent wood such as Canadian hemlock, will remain effective against adults for at least 26 days. It is highly effective against the migrating larvae for a week or longer. The adults are paralysed and ultimately killed by an exposure of not more than 30 minutes ; the larvae must be exposed for 1–24 hours, according to the age of the film. The pyrethrum is the main toxic agent, the oil having little or no effect.

There were some indications that this film spraying method might be useful in the control of other indoor insects. Probably its most useful application is in cleaning up the residual infestation in empty warehouses and other buildings, when fumigation is not practicable or desirable.

Infestation by *E. elutella* and *P. interpunctella* has been successfully prevented by this method in 30,000 tons of dried fruits in warehouses in England. It has also been adopted for the protection of cacao and tobacco and greatly reduced infestation, but it was not possible to assess the results accurately, because these goods were not sterilised before being brought into store so that fresh infestation was continually being introduced.

The pyrethrum insecticide is not necessarily the only possible one for use in this method. Preliminary trials have shown that an organic

thiocyanate, β butoxy β′ thiocyanodiethylether, has a marked toxicity when applied in this way and may compare favourably with pyrethrum for some purposes.

FEYTAUD (J.). **Les avertissements agricoles dans la lutte contre l'eudémis et la cochylis.**—*Rev. Zool. agric.* **37** no. 3 pp. 33–40, 4 figs. Bordeaux, March 1938.

The method of controlling the vine moths [*Polychrosis botrana*, Schiff., and *Clysia ambiguella*, Hb.] by early application of insecticides to kill the larvae as soon as they hatch has been adopted in various parts of France during the last 30 years. Success depends on the proper timing of treatment, which is achieved by local observations on moth flight, for which bait traps provide the best data, and on the presence of eggs. Second-generation eggs on the smooth bunches can be seen with the aid of a magnifying glass, but the first-generation eggs on the florets are too difficult to distinguish to furnish useful data. For this generation, the stage of development of the inflorescences should also be taken into account. To get good coverage, the bunches must be well formed and the flower buds well spaced. In certain districts, timing based entirely on the development of the inflorescences is used, but as development of insect and food-plant are not absolutely parallel, this can only be done when numerous applications are to be made. Local observations are indispensable, especially if it is desired to make only one or two applications against the first generation and one against the second. In all districts where the individual properties are very small, the observations should be made by one person.

JANCKE (O.). **Zur Bekämpfung des Erdbeerblütenstechers.** [The Control of the Strawberry Blossom Weevil.]—*Obst u. Gemüsebau* **84** pt. 4 pp. 53–54, 1 fig. Berlin, 15th April 1938.

Tests with several proprietary insecticidal dusts in May 1937 against *Anthonomus rubi*, Hbst., on strawberry in a heavily infested field near Speyer showed that the best control (88 per cent.) was given by a single application of a derris dust, which was more effective than others containing mixtures of pyrethrum and derris or pyrethrum alone. Dusting should be carried out when the first injured blossoms are observed.

THIEM (H.). **Die Stecher (Rüsselkäfer) als Schädlinge des Obst- und Weinbaues.** [Weevils as Orchard and Vineyard Pests.]—*Kranke Pflanze* **15** no. 11 pp. 189–195, 1 fig., 1 pl. Dresden, November 1938.

Brief notes are given on the bionomics and control of a number of weevils, mostly of the genus *Rhynchites*, that attack the shoots, leaves or fruit of fruit trees and grape vines in Germany.

Accounts of *Rhynchites cupreus*, L., and *R. pauxillus*, Germ., have already been noticed [*R.A.E.*, A **22** 464; **25** 386]. Of the others, *R. coeruleus*, DeG., is widespread, but rarely causes much damage. The adults appear in early spring, feed on pear, apple, cherry and *Crataegus*, and occasionally on strawberry, and oviposit in young shoots, which wither and fall as a result of a cut below the point of oviposition. The larva develops in the shoot in May and June and falls with it to the ground, where it hibernates in a cell in the soil. In favourable years

the adults are said to appear in autumn and hibernate under bark on the trunk. Adults of *R. betulae*, L., which feed on the leaves, also cut into the leaf stems, causing the leaves to wither, and then roll the leaves to make shelters in which they oviposit. As a rule only one vine leaf is required for a shelter, but with fruit and other deciduous trees several leaves may be used. The larvae fall with the leaves to the ground, where they complete development. Owing to the regular use of stomach poisons in vineyards, outbreaks of *R. betulae* have become rare. Its occurrence in orchard districts is limited.

R. auratus, Scop., is common near Berlin, and sometimes occurs in such abundance that pails can be filled with the weevils by jarring the trees. It has a two-year life-cycle. The adults appear when the cherry begins vegetation, and attack the buds, blossoms, shoots and leaves of many fruit trees, cherry being most severely injured. The egg is laid in the fruit ; the larvae feed in the cherry-stones, and when full-fed, migrate to the ground. *Anthonomus rectirostris*, L., also attacks cherries, especially *Prunus avium*, but it completes development in the fruits, the adults emerging when these are ripe. Adults of *Rhynchites aequatus*, L., which appears to have a one-year cycle, destroy the reproductive organs in blossoms of many fruit trees. They appear in early spring, pair in May and June and oviposit in the fruit. The larvae fall to the ground with the fruit ; they may be found in late autumn in fruit still on the tree. *R. bacchus*, L., is less common than *R. aequatus* and has a two-year life-cycle, but is ocasionally able to decrease the apple crop by 80 per cent. The larvae remain in the ground for 13–14 months. The adults appear in autumn, feed on leaf and fruit buds, hibernate among dead leaves or in tree cracks for 3–4 months, feed in spring on the buds, leaves, shoots and fruit for about 3–4 weeks, and oviposit in the fruit from May to August. A female lays up to 230 eggs. The larvae remain in the soil for 13–14 months.

The measures recommended for the control of these weevils comprise the repeated removal of infested plant parts before the larvae have migrated to the ground, collection of the adults by jarring the plants in the cool morning hours, and dusting with an arsenical insecticide in early spring when the adults begin feeding, or spraying with 0·15 per cent. nicotine if bees are liable to be destroyed by arsenical poisons, repeated applications of dust or liquid preparations of derris-pyrethrum being also suitable in dry weather.

Vorträge der Pflanzenschutztagung der Biologischen Reichsanstalt am 10. Februar 1938. [Addresses at the Plant Protection Meeting of the German Imperial Biological Institute on 10th February 1938.] —*Mitt. biol. Reichsanst.* pt. 58, 113 pp., illust. Berlin, September 1938.

The following are summaries of most of the addresses delivered.

Köhler (E.). Die Bedeutung der Insekten für den Kartoffelbau [The Importance of Insects in Potato Growing], pp. 29–36. The four viruses that are widely distributed in potatoes in Germany are leaf-roll virus, which causes true leaf-roll disease and is malignant in most varieties, Y-virus, which produces Y-streaks and is also malignant in most varieties, A-virus, which causes a slight mosaic disease, and X-virus, which is usually harmless and is rarely found in field plants. Mixed infections are common everywhere, and A and X

form a combination malignant in many varieties and producing crinkle or streak according to the variety concerned.

Capsids, Jassids and Aphids are the sucking insects common on potato. In transmission experiments with Capsids, K. Heinze obtained negative results with the leaf-roll, Y and X viruses; tests with the A-virus were not carried out. Experiments with Jassids also proved negative [*R.A.E.*, A **26** 68]. The Aphids, *Aphis rhamni*, Boy., *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) and *M. solani*, Kalt. (*Myzus pseudosolani*, Theo.) are also abundant on potato in Germany, but their rôle as vectors needs investigation. *Myzus persicae*, Sulz., is abundant and transmits leaf-roll, A and Y viruses. It hibernates in the egg stage on peach and, to a less extent, on apricot. It does not appear able to hibernate otherwise [*cf.* **22** 386, etc.], at least in the north-eastern part of Germany, except perhaps in an exceptionally mild winter, and districts in which peach is abundant are those in which the degeneration of potato stocks is most marked. In north-eastern Germany, mosaic diseases, such as the A-virus, displace leaf-roll, and as *M. persicae* is considered to transmit both viruses, it would seem that mosaic is also carried by other Aphids, *A. rhamni* being the most likely vector.

As the critical period for virus transmission is brief and coincident with the early stages of growth of potato, a treatment applied then should reduce the danger of infection. This was confirmed by an experiment in which the application of a nicotine spray on 9th June doubled the crop yield in a variety highly susceptible to infection. It is concluded that as *M. persicae* is the chief factor in degeneration of potato, peach trees should be eliminated as far as possible in potato districts or at least they should receive an effective winter spray.

Störmer (—). Die praktische Bekämpfung der Viruskrankheiten bei der Kartoffel [The practical Control of Potato Virus Diseases], pp. 37–46. Virus diseases cause degeneration of potato resulting in a crop loss of 15 per cent. in Germany. The viruses chiefly responsible are leaf-roll, streak and A-virus, which are transmitted by *Myzus persicae*, X-virus, of which the mode of transmission is unknown, being of little importance. Secondary infection, which is the condition that results when the potato plant grows from an infected tuber or from a shoot infested at a very early stage, is observed in April and May, during the first development of the plant, but primary infection of a previously healthy plant may occur as late as August and produce no symptoms during the season, at any rate in the case of streak, the commonest virus in Germany. Thus, the destruction of evidently infected plants only is of little value. The removal from the fields every 14 days of all plants suspected of infection has proved highly efficient against virus diseases in comparatively restricted areas in Holland, where the climate is damp (28–32 inches annual rainfall), but not in the immense potato areas in north-eastern Germany, where the rainfall is 20–24 inches. Measures against *M. persicae* are therefore necessary. Until all peach trees can be eliminated, a winter spray effective against the eggs should be applied, and the trees should be sprayed repeatedly with nicotine during the early period of vegetation. The Aphid should also be controlled in the potato fields by adding nicotine to the customary fungicides. Some results seem to indicate that Bordeaux mixture, sprayed repeatedly, reduces virus infection;

the author suggests that this may be partly due to mechanical destruction of the Aphid in the process of spraying as, when a power sprayer is used, the plants are blown as by a strong wind. It has recently been found that seed potatoes that are almost or completely free from the virus are obtained by late cultivation of potatoes intended for seed production. When the parent plant does not develop in the field before 10th July, the maximum transmission by Aphids is over and the descent to the young tuber of any virus in the aerial plant part occurs to a less degree or not at all.

Schwartz (M.) & Müller-Böhme (H.). Untersuchungen über die Kartoffelkäfer-Widerstandsfähigkeit von Kartoffelwildformen und von Kreuzungen solcher Wildformen mit Kulturformen [Investigations on the Capacity for Resistance to *Leptinotarsa decemlineata*, Say, of wild Species of Plants allied to Potato and of Crosses between them and cultivated Potato], pp. 47–54. Schaper (P.). Das Verhalten verschiedener Wildspezies gegen den Kartoffelkäfer [The Behaviour of various wild Species of *Solanum* towards *L. decemlineata*], pp. 55–60. Schaper (P.). Das Verhalten der wichtigsten Kultursorten gegen den Kartoffelkäfer im freien Befall [The Behaviour of the principal cultivated Varieties of Potato towards Field Infestation by *L. decemlineata*], pp. 61–67. The subject matter of the first two papers has been noticed from another source [**27** 107]. From observations recorded in the third paper, six cultivated varieties of potato are recommended for further investigation. A brief note on insecticides forms the final section of the first paper. A proprietary dust of pyrethrum and derris is stated to have killed larvae of *L. decemlineata* in the second, third and fourth instars. As the suspension power of calcium arsenate is improved by the addition of a mixture of magnesium sulphate and lime [**25** 764], experiments were made with this combination, and it was found that larvae and adults of the beetle preferred foliage sprayed with it to foliage sprayed with calcium arsenate alone. Furthermore, the mixture of magnesium sulphate and lime by itself was injurious to *L. decemlineata*, so that it would seem possible to reduce the calcium arsenate content in sprays containing the mixture.

Haupt (W.). Bericht über die Ergebnisse der im Jahre 1937 durchgeführten Versuche zur Ermittlung des Regenerationsvermögens an Kartoffelsorten [Report on the Results of Experiments in 1937 to ascertain the Power of Recuperation of Varieties of Potato], pp. 69–76. Some varieties of potato suffer more severely from attacks by *L. decemlineata* than others. Experiments were made in 1937 with 18 varieties, the plants being cut with special scissors to simulate the injury done by the beetle. Varying percentages of the leaf-mass were removed at intervals to correspond with early and late attack. The results, which are tabulated and illustrated, show that early mutilation caused a heavy crop loss (yields from 17·2 to 61 per cent. of the control according to variety) while late mutilation was far less harmful (yields from 35·1 to 89·6 per cent.).

Makkus (W.). Kartoffelkäfer-Bekämpfungsversuche mit Kalkstickstoff in Bussière-Dunoise (Creuse) [Experiments at Bussière-Dunoise (Creuse) with Calcium Cyanamide against the Potato Beetle], pp. 77–85. Several grades of calcium cyanamide were used in these tests in France in 1936 and 1937. On the completion of manufacture, calcium cyanamide is often treated with 2·5 per cent. mineral oil to prevent excessive dust, and one of the samples used was oiled. It was found

that manuring infested soil with calcium cyanamide at the usual agricultural rate prevented or hindered the emergence of the adults of *Leptinotarsa* from their winter quarters, and that the oiled cyanamide was superior to others in this respect. As the oil did not have any specific action on the beetles, it is believed that its effect lies in retarding the decomposition of the calcium cyanamide ploughed into the ground. Experiments on field plots of dry potato plants showed that one application of calcium cyanamide as a dust at the rate of 27–36 lb. per acre killed the larvae within 1–4 days and that rain after dusting did not apparently reduce the larvicidal action. Scorching occurs if wet plants are dusted, but in normal weather conditions the foliage was not harmed by calcium cyanamide applied at the rate of 36 lb. per acre. The larvicidal effect was greater than that of a spray of 2 per cent. arsenate containing 16 per cent. As_2O_5 or of 1 per cent. cryolite containing 47–49 per cent. fluorine.

Sy (M.). Ergebnisse der Versuche über die Gefährdung von Singvögeln durch arsenhaltigen Pflanzenschutzmittel [Results of Experiments on the Risk to Song Birds of arsenical Insecticides], pp. 103–113. In these experiments, grain feeders were represented by grossbeaks (*Chloris chloris*) and finches (*Fringilla coelebs*) and insect feeders by great tits (*Parus major*), and commercial calcium arsenate and lead arsenate sprays and dusts were used. Each test was made with 10–12 birds caged separately, half of each batch being controls. The tits were not poisoned by eating sprayed silkworms placed on sprayed leaves. No tests on these birds were made with dusts. The grain feeders were not poisoned by sprayed grain, evidently because the poison adheres to the husks, which are removed by the birds. They were poisoned by dusts, even in weak dosages, but were repelled by the poisoned grain and would not eat it if other food was available.

Dumbleton (L. J.). **Notes on a new Mirid Bug (*Idatiella albisignata* Knight).**— *N.Z. J. Sci. Tech.* (B) **20** no. 1 pp. 58B–60B, 3 figs., 1 ref. Wellington, N.Z., July 1938.

Idatiella albisignata, Knight, has been recorded from New Zealand on apple and pear, and from South Australia and Tasmania on apple. The original description of the adult [*R.A.E.*, A **26** 247] is quoted, and the eggs and nymphs are described briefly. There is no evidence that this Capsid damages the fruit of apple, and though the nymphs and adults feed readily on the young shoots and leaves of both apple and pear, and the nymphs can be reared to maturity on them, the leaves do not appear to be injured. The Capsid commonly occurred on pear leaves infested with *Dasyneura pyri*, Bch., and it is possibly sometimes predacious upon this and other insect pests of apple and pear. In cages, the adults did not attack Aphids, and did not kill larvae of *Dasyneura* in a curled pear leaf on which they fed, but a female confined with exposed larvae of the midge fed on several of them. In the laboratory, adults did not live longer than 10 days. The eggs were embedded in the soft tissues of the young shoots; the site was usually distinguishable by its brownish colour.

In South Island, New Zealand, the nymphs were present from about the end of September to the end of November and from mid-December to mid-February. The adults appeared in mid-November and occurred again from mid-January to early March. It is not known in what stage the Capsid overwinters.

Linsley (E. G.). **Longevity in the Cerambycidae.**—*Pan-Pacif. Ent.* **14** no. 4 p. 177. San Francisco, Calif., October 1938.

Adults of *Stromatium fulvum*, Villers, are recorded as emerging in October 1935, July 1937 and August 1938 from furniture that had been imported into California from Italy in 1925 and had been manufactured just prior to export. Larvae were still present in some numbers in August 1938 and so must have lived in the wood for at least 13 years.

Papers noticed by Title only.

Soliman (L. B.). **Two Genera and Species of Aphids new to Science** [from Egypt].—*Bull. Minist. Agric. Egypt* no. 208, 6 pp., 8 pls. Cairo, 1938.

Wahlgren (E.). **Svenska bladlöss** (*Aphidina*). [The Aphids of Sweden (a list with food-plants).]—*Ent. Tidskr.* **59** no. 3–4 pp. 166–187, 14 refs. Stockholm, 1938. **Zwei neue Blattläuse.** [Two new Aphids from Sweden.]—*T.c.* pp. 188–189, 3 refs.

Hukkinen (Y.). **Alopecurustripsen** (*Chirothrips hamatus*), **ett nytt skadedjur för alopecurusfröet.** [*C. hamatus*, Tryb., a new Pest of the Seeds of *Alopecurus pratensis* in Finland.]—*Medd. Lantbruksförsöksv.* no. 133, 9 pp., 7 figs. Helsingfors, 1938. [*Cf. R.A.E.*, A **25** 306.]

[Chuvakhin (V. S.).] **Чувахин (В. С.). Instructions for surveying and controlling Locusts, Grasshoppers and Crickets.** [*In Russian.*] —Demy 8vo, 48 pp., 20 figs. Moscow, Izd. Narkomzema SSSR, 1938.

Heikertinger (F.). **Ueber die Insektennahrung der Erdkröte** (*Bufo vulgaris* **Laur.**). [The Insect Food of the Toad (remains of insects found in excreta in Austria).]—*Koleopt. Rdsch.* **24** no. 5 pp. 181–189, 2 figs. Vienna, 1st October 1938.

Weitere Kartoffelkäferfunde an der Westgrenze. [Further Records (between 1st July and 27th September 1938) of the Potato Beetle (*Leptinotarsa decemlineata*, Say) on the western Frontier of Germany.]—*Beil. NachrBl. dtsch. PflSchDienst* **18** no. 11, 11 pp. Berlin, November 1938. [*Cf. R.A.E.*, A **27** 48.]

Massee (A. M.). **Coleoptera associated with cultivated Fruits** [an annotated list of some 70 species occurring in England].—*Trans. Soc. Brit. Ent.* **5** pt. 5 pp. 223–234. Southampton, 9th November 1938.

Schwerdtfeger (F.). **Die wichtigeren forstpathologischen Arbeiten des Jahres 1937.** [The more important Papers of 1937 on Forest Pests and Diseases (an annotated bibliography of 77 titles).]—*Forstarchiv* 1938 pt. 12 repr. 10 pp., 77 refs. Hanover, 1938.

Schneider-Orelli (O.). **Neuere Forschungsergebnisse aus dem Gebiete der Forstentomologie.** [Recent Results of Investigations in Forest Entomology (a summary of literature).]—*Schweiz. Z. Forstwes.* 1938 no. 10, repr. 16 pp., 12 figs., 20 refs. Bern, 1938.

REVISTA DE ENTOMOLOGIA

An International Review of Entomology

An illustrated magazine published four times a year by **THOMAZ BORGMEIER, O.F.M.,** devoted to entomology, mainly of the neotropical fauna.

The seven volumes already published (1931–1937) comprise more than 3,500 pages and contain articles by leading entomologists such as W. M. Wheeler, F. W. Edwards, W. Horn, E. Lindner, E. Martini, A. da Costa Lima, F. Silvestri, C. Menozzi, A. Reichensperger, F. Santschi, D. Moulton, etc., with a bibliography of the current literature (economic and non-economic) of the neotropical fauna.

Beginning with 1938, two volumes per year will be published, price per volume $4.00 U.S. ($5.00 U.S. through booksellers). Annual subscription $8.00 U.S. ($10.00 U.S. through booksellers). All payments are in advance. Volumes 1–7 are still on sale; price of each volume 4 U.S. dollars; through booksellers 5 U.S. dollars.

Subscriptions should be sent to the Editor: Thomaz Borgmeier, O.F.M., Convento S. Antonio, Largo da Carioca, Rio de Janeiro, Brazil.

ZOOLOGICAL RECORD—PART INSECTA.

The "Insecta" part of the "Zoological Record" is published annually about July at 15/6 post free.

It contains as complete a record as possible of the entomological literature of the previous year and comprises three main sections:—

1. Titles of papers, over 3,000 in number, arranged under authors;
2. an Index dealing with such subjects as Morphology, Physiology, Ecology, etc.;
3. a Systematic portion, which occupies about half the whole. This constitutes a classified index of all the new genera and species of insects that have been published during the year, as well as references to general papers on systematics.

Orders should be addressed to *The Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.*

Orders for the *complete* volume of the "Zoological Record" (as opposed to the "Insecta" part) should be sent to the Zoological Society of London, Regent's Park, London, N.W.8.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

LIBRARY LACUNAE.

The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7

The Kenya and East African Medical Journal (Nairobi) : Vol. II Nos. 2–3 (1925).

Natuurhistorisch Maandblad (Maastricht) : Jaarg. I (1912) : II (1913) Nos. 1–4, 6–9 ; V (1916) Nos. 3–4 ; VII (1918) Nos. 6–9 ; VIII (1919) No. 4.

New Jersey State Department of Agriculture (Trenton, N.J.) : Bulletin 2 ; Circular : 2, 12, 29 (1917–19).

New York State Museum (Albany, N.Y.) : Bulletin : 26 & 57 (1899–1902).

Ontario Entomological Society Report (Toronto) : 9th (1878).

Ormerod (E. A.). Observations of Injurious Insects and Common Farm Pests during the Years 1877 & 1878 (London, 1878–79).

Philippine Agriculturist and Forester (Manila) :
Vols. II Nos. 1–3 (1912) ; III Nos. 1, 2 (1914) ; IV No. 4 (1915).

Philippine Journal of Science (Manila) : Vol. I (1906) No. 10.

Porto Rico Department of Agriculture, &c. (San Juan) :
Journal, Vol. I (1917) No. 3.

Psyche (Boston, Mass.) : Vols. XI (1904), XIII (1906), XVI (1909).

Records of the Egyptian Government School of Medicine (Cairo) : Vol. I.

Revista de Agricultura de Puerto Rico (San Juan) :
Vols. I (1918) Nos. 1–2 ; II (1919) Nos. 5–6 ; III (1919) Nos. 3–4 ; VIII (1922) No. 2 ; IX (1922) Nos. 5–6 ; X (1923) Nos. 1, 5, 6.
Indices to Vol. VI–XVI.

Revista Chilena de Historia Natural (Santiago) : Año XIV (1910) Nos. 4–6 ; XV (1911) Nos. 1 and 3 to end ; XVI, XVIII, XXVI (1912, 1914, 1922).

Revista de Veterinaria e Zootechnia (Rio de Janeiro) :
Annos I–II (1911–12). Anno III (1913) Nos. 1 to 3, and 5.

La Revue de Phytopathologie appliquée (Paris) : Tome I Nos. 22–23 (April-May, 1914).

Rhodesia Agricultural Journal (Salisbury) :
Vol. I Nos. 1, 3–6 ; II Nos. 2–4 ; III Nos. 1, 2, 6 ; IV No. 4 ; V No. 4 (1903–08) ; VII (1909–10) Nos. 1 & 6 ; IX (1912) No. 5 ; X (1912) No. 1. Title pp. and indices to Vols. I–V, VII, VIII, X.

Rivista di Patalogia vegetale (Florence) : Vols. VII–X (1899–1904).

Sciencia medica (Rio de Janeiro) : Anno I Nos. 2–3, 5–6 ; II Nos. 1–10, 12.

South London Entomological and Natural History Society :
Report, 1879–84.

Tennessee Agricultural Experiment Station (Knoxville) :
10th (1897), 12th (1899), and 16th (1903) Annual Reports.

Tennessee State Board of Entomology (Knoxville) :
Bulletin : 15, 24, 25, 28, 29, 34, 39.

Teysmannia (Batavia) : 32ste Jaarg. (1921) 10e Afl.

De Thee (Buitenzorg) : 6e Jaarg. (1925) No. 1.

Tijdschrift over Plantenziekten (Wageningen) :
Jaarg. I (1895) and XVI-XVII (1910–11).

Timehri : The Journal of the Royal Agricultural and Commercial Society of British Guiana (Demerara) :
Third Series, Vols. I Nos. 1–2 ; II No. 2 to end ; III Nos. 2 to end ; IV–V (1911, 1913–18).

United States Department of Agriculture (Washington, D.C.) :
Howard (L. O). Report of the Entomologist, 1895.

Virginia : Agricultural Experiment Station (Blacksburg, Va) :
Bulletins 24, 61 (1893–96). Technical Bulletin 8 (1915).

Virginia : 1st Annual Report of the State Inspector for San José Scale, 1896–97 (Richmond, Va., 1897).
4th Report of the State Entomologist and Plant Pathologist (Richmond, Va., 1905).

West Indian Bulletin (Barbados) : Title-page & Index to Vol. IV.

Zeitschrift für das Landwirtschaftliche Versuchswesen in Österreich (Vienna) : 21. Jahrg. (1918) Hefte 1–3 & 10–12.

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Assistant Director.

The Annual Subscription, *in advance*, to the Review, Series A (Agricultural), is 30s. post free; Series B (Medical and Veterinary), 15s. post free. Subscriptions to the *current* Volume received after 30th June in each year will be charged at the published price *viz.*: Series A, 36s.; Series B, 18s. Prices of Back Volumes on application.

Orders and subscriptions should be sent direct to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS.

	PAGE
AFRICA: Studies of the Mosaic Diseases of Cassava	153
AFRICA, EAST: Insect Pests in Nyasaland in 1937	125
AFRICA, EAST: Pests of Coffee in Tanganyika in 1937	126
AFRICA, NORTH: *Hylemyia sepia* on Wheat in Morocco	124
AFRICA, NORTH: Two new Aphids from Egypt (*Title only*)	160
AFRICA, SOUTH: Miscellaneous Pests in S. Rhodesia in 1937	124
AFRICA, SOUTH: *Myzus persicae* and Tobacco Rosette in S. Rhodesia	125
AUSTRALIA: Campaigns against *Chortoicetes terminifera* in New South Wales	130
AUSTRALIA, WESTERN: Sprays against *Lepidosaphes ulmi* on Apple	130
AUSTRALIA, WESTERN: Regulations for the Control of Fruit-flies	130
AUSTRALIA, WESTERN: A Population Study of *Halotydeus destructor*	131
BRAZIL: A new Weevil infesting Cabbage	132
BRAZIL: The Biology of *Gasterocercodes brasiliensis* in Pernambuco	136
BRITISH ISLES: *Erythroneura pallidifrons* and its Control in Greenhouses	115
BRITISH ISLES: Experiments against *Hylemyia brassicae* on Cauliflowers	116
BRITISH ISLES: A Record of *Pyrausta nubilalis* in Essex	116
BRITISH ISLES: Insect Pests in Scotland in 1937	122
BRITISH ISLES: Protective Films of Insecticide against *Plodia* and *Ephestia*	154
BRITISH ISLES: Coleoptera associated with cultivated Fruits (*Title only*)	160
CHINA: *Diacrisia obliqua* on Lima Beans	129
CZECHOSLOVAKIA: A List of Leaf-mining Insects	145
CZECHOSLOVAKIA: Hosts of *Theronia atalantae*	145
DANZIG: Studies of an Outbreak of *Diprion pini*	105
DENMARK: Insect Pests in 1937	117
EUROPE: An international Conference on *Leptinotarsa decemlineata*	106
FINLAND: *Chirothrips hamatus* on *Alopecurus pratensis* (*Title only*)	160
FRANCE: Timing of Insecticide Applications against the Vine Moths	155
GERMANY: A new Tettigoniid in Hot-houses	109
GERMANY: The principal Pests of Horse-radish	110
GERMANY: The Infestation of Buildings by *Hylotrupes bajulus*	110
GERMANY: Leaf-feeding by Larvae of the Vine Moths	111
GERMANY: The Rearing of Vine Moths for Insecticide Tests	111
GERMANY: The Resistance of Female Ants to Arsenicals	112
GERMANY: Pairing, Fertilisation and Oviposition in *Operophtera brumata*	112
GERMANY: Records of Braconid Parasites	113
GERMANY: An Experiment with *Leptinotarsa decemlineata* and Tomato	113
GERMANY: Sawflies on Fruit Trees and Berry Bushes	114
GERMANY: Destruction of hibernating Larvae of *Cydia pomonella* by Birds	114
GERMANY: Standards required for Calcium Arsenates	115
GERMANY: Tests of Dusts against *Anthonomus rubi*	155
GERMANY: Weevils attacking Fruit Trees and Vines	155
GERMANY: Pests and Diseases of Potato	156
GERMANY: The Insect Food of the Toad in Austria (*Title only*)	160
GERMANY: Records of *Leptinotarsa decemlineata* (*Title only*)	160
INDIA: Mites injurious to cultivated Plants	127

INDIA : Entomological Work connected with Lac Cultivation in 1937–38 128
INDIA : Pyralids attacking *Coleus parviflora* 129
ITALY : Sprays against the Pear Psyllid 115
NEW CALEDONIA : A Note on *Dacus psidii* 131
NEW ZEALAND : Observations on *Idatiella albisignata* 159
PALESTINE : Insect Pests in 1937–38 127
POLAND : Experiments with a Fungus against *Piesma quadratum* ... 105
RUSSIA : Lucerne Pests and their Control 108
RUSSIA : Breeding Areas of *Locusta migratoria* in the Manuich Depression 109
RUSSIA : The Detection of Seed Pests by Means of X-rays 147
RUSSIA : The Effect of Temperature on Pupae of *Heliothis armigera* ... 147
RUSSIA : The Use of *Trichogramma evanescens* against *Pyrausta nubilalis* 148
RUSSIA : A new Sulphur Preparation against Mites 150
RUSSIA : Pests attacking Sweet Lupins 150
RUSSIA : *Pediculopsis graminum* as a Pest of Grasses 151
RUSSIA : *Etiella zinckenella* infesting Watermelons 152
RUSSIA : Damage to Willows by *Pyrausta nubilalis* 152
RUSSIA : Frame Determination of the Density of Grasshopper Populations 153
RUSSIA : Methods of counting Flea-beetles hibernating in Soil 153
RUSSIA : Surveys and Control of Locusts (*Title only*) 160
RUSSIA, ASIATIC : The Forecasting of Infestation of Cotton by *Tetranychus* 147
RUSSIA, ASIATIC : Observations on Coccids on *Citrus* near Batum 148
RUSSIA, ASIATIC : A Calcium Cyanide Preparation against Coccids on *Citrus* 149
RUSSIA, ASIATIC : A Weevil attacking Beet in Kazakstan 152
RUSSIA, ASIATIC : A Scolytid infesting Juniper in Central Asia 153
RUSSIAN UNION : Local Races of *Trichogramma* and their Utilisation ... 109
RUSSIAN UNION : The Basis of the Distribution of injurious Insects ... 145
SWEDEN : Investigations on *Apion* spp. attacking Clover 117
SWEDEN : The Bionomics and Control of *Calandra granaria* and *C. oryzae* 118
SWEDEN : Thysanoptera on Grasses and Cereals 121
SWEDEN : An Outbreak of *Ips typographus* 122
SWEDEN : The Biology of *Hylastes palliatus* 123
SWEDEN : A Review of the Aphids, with new Species (*Title only*) ... 160
U.S.A. : The Bionomics and Distribution of *Tetrastichus brevistigma* ... 132
U.S.A. : New Species of *Apanteles* from California 133
U.S.A. : Tests of Sprays against *Cydia pomonella*, etc., in Missouri ... 133
U.S.A. : Inorganic and organic Compounds in Grasshopper Baits ... 134
U.S.A. : Progress of Work against some Insect Pests in 1937 138
U.S.A. : The Species and Distribution of Grasshoppers in recent Outbreaks 139
U.S.A. : An unusual Type of Injury to Pines by *Pityophthorus* spp.... 140
U.S.A. : Moth-proofing Preparations and Methods of testing them ... 140
U.S.A. : Annual Insect Population Records, particularly the Kansas Summary 140
U.S.A. : Studies on Resistance of Apple Varieties to *Eriosoma lanigerum* 141
U.S.A. : Control of Mites and Thrips by a Derivative of Cyclohexylamine 141
U.S.A. : Characters of Bean and Tomato Leaves that destroy small Insects 142
U.S.A. : A Note on the attempted Establishment of *Theresia* 143
U.S.A. : Longevity of a Cerambycid in imported Furniture 160
The Testing of the Value of Fumigant Insecticides 111
The Influence of Humidity on Eggs of *Melolontha melolontha* 112
Condition of the Food-plant affecting Infestation by Coccids 112
The Nomenclature of Anthomyiids injurious to Plants 113
Evaluation of Pyrethrum by Tests on Mosquito Larvae 134
Effect of Aqueous Extraction on Pyrethrin Content of Pyrethrum ... 135
The Meaning of the Terms Brood and Generation 137
Radio Waves and related Forms of Energy for Insect Control 137
Some Phases of Entomological Writing 138
The Ratio of Lead to Arsenic in Spray Residues 139
The Relation of Dilution to Insecticidal Efficiency of Dusts 139
Toxicity to Insects of Fractions of commercial Phenothiazine 142
Weight of Foliage in Relation to Insect Control 143
A Microtechnique for testing Oil Insecticides on Coccids 143
Effects of Cold Storage on Reproduction of Hymenopterous Parasites ... 144
Recent Literature on Forest Pests (*Titles only*) 160
LEGISLATION : Regulations for the Control of Fruit-flies in W. Australia 130

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE
by the South Essex Recorders, Ltd., Ilford.

(588) Wt. P9/3056 1700 3/39 S.E.R. Ltd. **Gp. 432.**